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Clinical Nursing Skills

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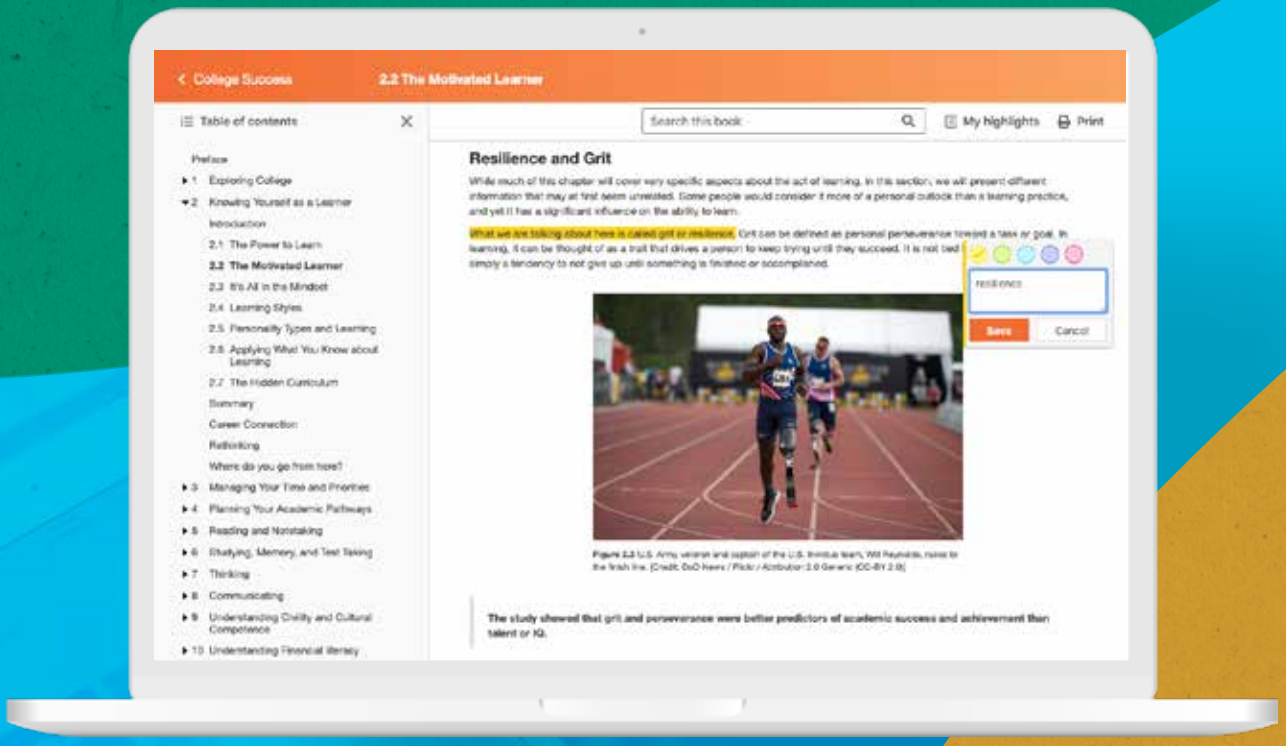

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PREFACE

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About *Clinical Nursing Skills*

Summary

Clinical Nursing Skills is designed to equip nursing students with the practical knowledge and hands-on skills necessary to provide comprehensive patient care. This text emphasizes the application of clinical judgment in a variety of settings, ensuring that students are prepared to deliver high-quality care across different patient

populations and clinical scenarios. Covering a wide range of clinical skills, including fundamental nursing procedures, advanced technical skills, and critical thinking techniques, the book provides step-by-step instructions and evidence-based guidelines to help students master the competencies required for effective nursing practice.

The text explores fundamental nursing skills, offering detailed instructions on basic procedures such as hygiene, mobility, vital signs assessment, medication administration, and wound care. It also guides students through more complex skills, including intravenous therapy, catheterization, tracheostomy care, and emergency interventions. By integrating the Clinical Judgment Measurement Model, the book helps students recognize, analyze, prioritize, create, act, and evaluate outcomes in various clinical situations, fostering critical thinking and clinical decision-making.

By studying *Clinical Nursing Skills*, students will gain the confidence and competence needed to perform essential nursing tasks, make informed clinical decisions, and provide compassionate, patient-centered care. This text serves as a foundational resource for nursing students, preparing them for success in their clinical rotations and future professional practice.

Pedagogical Foundation

Clinical Nursing Skills provides a thorough and evidence-based introduction for entry-level undergraduate nursing students. The focus is on performing a comprehensive assessment. Content includes normal and abnormal findings, explanation of how the body maintains homeostasis, and its systems as a critical component of health and wellness. The content utilizes concepts promoting the development of clinical judgment by building upon the systematic model developed by the National Council of State Boards of Nursing (NCSBN).

Clinical Nursing Skills is structured to support the flexible integration of nursing skills content across both system-based and nursing competency-based curricula and can be used whether skills assessment is taught as a stand-alone course or as part of another nursing course. The text describes techniques for obtaining a health history and performing a basic physical assessment using a body systems approach. It also includes evidence-based clinical skills with related mathematical calculations and conversions. Tailoring this text to nursing students helps prepare them not only throughout the curriculum but also as a prerequisite to direct patient care. Instructors may pair the chapters from this textbook with similar body system topics in a disease course, such as Fundamentals, or Medical-Surgical Nursing.

Organizational Framework

The table of contents for Clinical Nursing Skills presents content in 28 chapters, organized into 4 thematic units:

- **Unit 1** features introductory chapters that introduce concepts of comprehensive clinical care include historical nursing profession knowledge, foundational skills for performing a comprehensive assessment, cultural competence, and infection control and prevention.
- **Unit 2** covers general assessment and special considerations the assessment findings of the body's systems.
- **Unit 3** details medication management, including the principles and procedures of dosage calculation.
- **Unit 4** dives into the skills and assessment of each body system. The final chapter includes a dissection of an unfolding case study. Utilizing the Clinical Judgment Measure Model, students can develop critical thinking skills more deeply.

Nursing Features

To further enhance learning, *Clinical Nursing Skills* includes the following features:

- **Clinical Judgment Measurement Model** boxes guide students through the application of the Clinical Judgment Measurement Model in clinical practice. The content explores the critical thinking and decision-making processes necessary to navigate patient care at different points in the process, from recognizing cues to evaluating outcomes.
- **Clinical Safety and Procedures (QSEN)** align with the Quality and Safety Education for Nursing competencies by providing step-by-step procedures in specific clinical settings to ensure proper protocols are followed, evidence-based practice is explained, and patient safety remains the focus.
- **Cultural Context** boxes highlight cultural considerations as they relate to specific skills or topics. Cultural differences, such as skin tone or hair texture, may affect the way certain conditions or symptoms present or impact the steps a nurse takes. These boxes help students pay attention to these differences and explain how

they may impact their approach to patient care.

- **Life-Stage Context** boxes highlight age considerations across the life span as they relate to specific skills or topics. For example, age might affect the steps a nurse takes to bathe a neonatal patient as compared to an older child or adult.
- **Link to Learning** features provide a very brief introduction to online resources—videos, interactives, collections, maps, and other engaging resources that are pertinent to students' exploration of the topic at hand.
- **Patient Conversations** present students with short dialogues between a nurse and a patient, a family member of a patient, or another nurse to help students sharpen their critical thinking and communication skills in the clinical setting.
- **Real RN Stories** feature vignettes from actual nurses who faced a problem related to chapter topics. Reading a story about a topic makes it real for the learners and helps them unlock concepts and make connections in a way that mere descriptions cannot. The nurses highlighted in this feature represent a diversity of scholars with experience in various clinical settings and who vary in terms of age, geographic location, gender, and racial and cultural background.
- **Unfolding Case Studies** present a hypothetical client scenario that unfolds in parts throughout the chapter, with each subsequent part presenting new information on the same client, to help foster clinical judgment. In each part of an unfolding case feature, the scenario is followed by questions that require students to apply their knowledge of evidence-based care and allow them to practice with questions that mimic the style of Next-Gen NCLEX. The answers to these questions, with explanations, are included in the Answer Key for students at the end of the book.

Pedagogical Features

To support student learning, *Clinical Nursing Skills* includes the following standard elements:

- **Learning Outcomes:** Every chapter section begins with a set of clear and concise student learning outcomes. These outcomes are designed to help the instructor decide what content to include or assign and can guide students on what they can expect to learn and be assessed on.
- **Assessments:** A variety of assessments allow instructors to confirm core conceptual learning, elicit brief explanations that demonstrate student understanding, and offer more in-depth assignments that enable learners to dive more deeply into a topic or history-study skill.
    - **Review Questions** test for conceptual comprehension of key concepts.
    - **Check Your Understanding Questions** require students to explain concepts in words.
    - **Reflection Questions and Competency-Based Assessment Questions** dive deeply into the material to support longer reflection, group discussion, or written assignments.
    - **What Should the Nurse Do? and Critical Thinking About Case Study Questions** assess students' clinical judgment skills using case-based scenarios. Students review either a single case or an unfolding case that reveals information gradually. In response to their observations of the patient, students must decide how to navigate the Clinical Judgment Measurement Model process. This approach challenges them to apply theoretical knowledge to practical situations, determining the most appropriate interventions based on the patient's specific circumstances.
- **Answers to Questions in the Book:** The assessments are intended for homework assignments or classroom discussion; thus, student-facing answers are not provided in the book. Answers and sample answers are provided in the Instructor Answer Guide for instructors to share with students at their discretion, as is standard for such resources.
- **Chapter Summary:** Chapter summaries assist both students and instructors by outlining the primary subtopics addressed within the chapter.
- **Key Terms:** Key terms are presented in bold text and are followed by an explanation in context. Definitions of key terms are also listed in the end-of-chapter glossary.
- **References:** References are listed at the end of each chapter.

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Christy Bowen, Chamberlain University. Dr. Christy Bowen DNP, RN, serves as the Dean of Academic Affairs for Chamberlain University's BSN-Online. Dr. Bowen holds an ASN from Excelsior University, a BSN in Nursing and MSN in nursing education with a focus in curriculum development and revision from Western Governor's University, and a Doctor in Nursing Practice in nursing leadership and management from Capella University. Dr. Bowen has been a nurse for more than twenty years and is certified in the specialty of critical care nursing, and wound care. In her clinical practice she held roles such as Department Chair, Unit Educator, and Lead Nurse. In her academia role, she has served as Lead Instructor, Curriculum Chair, Program Coordinator, Program Director, and Associate Dean of Faculty. Dr. Bowen has taught courses throughout all levels of nursing education such as associate, bachelor, master, and doctoral level programs. She enjoys teaching both clinical and didactic learning for nursing students. Dr. Bowen served as a key member of the curriculum team to develop a concept-based curricula as part of the Texas Nursing Concept-Based Curriculum (TxNCBC) project and develop a standardized concept-based curriculum for the state of Texas. She has led over fifty Workshops as part of the implementation and customization service for schools across the United States transitioning to concept-based nursing. She developed over twenty board of nursing continuing education certified workshops and presented as keynote speaker for all workshops to universities and colleges across the United States. Throughout Dr. Bowen's career, she has received many prestigious awards including Nurse of the Year, Clinical Nurse Leader of the Year, Employee of the Year, Top Requested Nursing Education Consultant (NEC), Phi Theta Kapa Faculty Member of the Year, and Presidential Award Outstanding Faculty Service.

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PowerPoint lecture slides. The PowerPoint slides provide learning objectives, images and descriptions, feature focuses, and discussion questions as a starting place for instructors to build their lectures.

Skills checklists. The skills checklists resource, linked throughout each chapter, identifies step-by-step competency checklists for commonly performed nursing skills.

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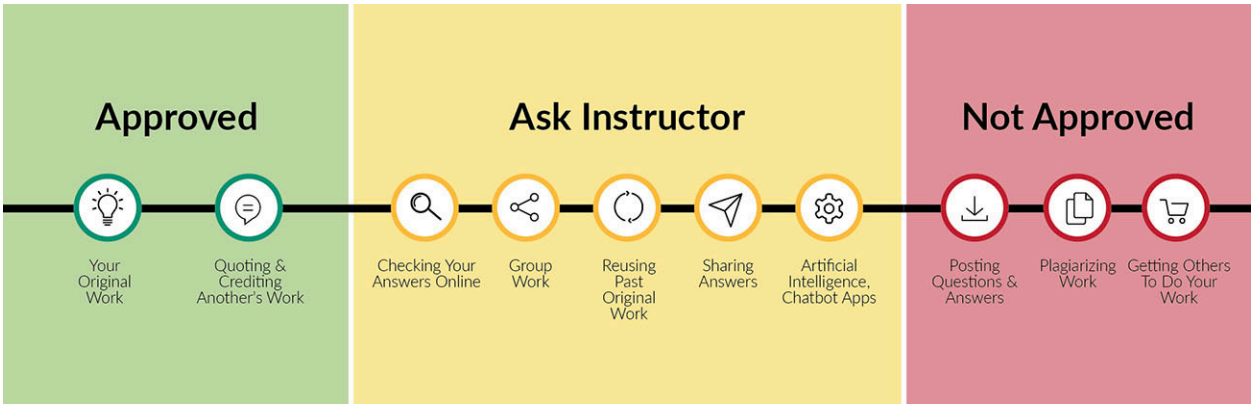

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CHAPTER 1
The Role of the Nurse in Comprehensive Care

FIGURE 1.1 The role of comprehensive nursing care is to provide holistic and patient-centered care that addresses the physical, emotional, social, and spiritual needs of patients, families, and communities. (credit: modification of work "Day in the Life: Labor and Delivery Nurse" by R.J. Oriez/U.S. Air Force, Public Domain)

CHAPTER OUTLINE

1.1 Principles of Nursing Practice
1.2 Evidence-Based Practice
1.3 Nursing Process

INTRODUCTION As aspiring nurses, you are about to embark on a journey that will showcase the multifaceted nature of nursing practice. Comprehensive care is the cornerstone of nursing practice, encompassing a holistic approach that considers not only the physical aspects of patients but also their emotional, psychological, and social well-being.

By adhering to the principles of nursing practice, which include person-centered care, professional integrity, and lifelong learning, nurses become advocates for their patients, ensuring that their needs and preferences are at the forefront of care. We will also cover the importance of establishing therapeutic relationships, effective communication, and cultural competence as essential components of comprehensive care.

1.1 Principles of Nursing Practice

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Define the goals of nursing practice
- Describe the primary ethical principles of nursing practice
- Identify how principles of clinical judgment are incorporated into nursing practice

As an aspiring nurse, it is important to understand the fundamental principles, goals, and ethics that guide the nursing profession. This section provides a comprehensive overview of the goals of nursing practice, the primary ethical principles that underpin nursing care, and the way principles of clinical judgment are incorporated into your daily practice to inform and guide your nursing care.

Nursing Definition and Goals

The most recent definition of nursing, according to the American Nurses Association (ANA) (2021), states "nursing integrates the art and science of caring and focuses on the protection, promotion, and optimization of health and human functioning; prevention of illness and injury; facilitation of healing; and alleviation of suffering through compassionate presence. Nursing is the diagnosis and treatment of human responses and advocacy in the care of individuals, families, groups, communities, and populations in recognition of the connection of all humanity."

The goals of nursing have evolved over time in response to changes in society, healthcare systems, and the understanding of healthcare needs. Historically, nursing was primarily focused on providing basic care, such as nutrition and comfort, during times of illness or injury. As health care advanced, nursing goals expanded to encompass a broader scope of practice. Florence Nightingale (Figure 1.2) is considered to be the founder of **holistic nursing care**, which emphasizes the healing of the whole person, including mind, body, and soul (American Holistic Nurses Association, 2023).

FIGURE 1.2 Florence Nightingale (1820–1910) is considered the founder of holistic nursing. (credit: "Three Quarter length portrait of Florence Nightingale" by Unknown/Wikimedia Commons, Public Domain)

The twentieth century saw significant progress in nursing education, research, professionalization, and technology. Nurses became actively involved in health promotion, disease prevention, and patient advocacy.

In recent decades, the goals of nursing have further evolved to emphasize evidence-based practice, patient-centered care, and interdisciplinary collaboration. Nurses now play critical roles in care coordination, healthcare leadership, and policy development. They actively engage in health promotion, disease management, and support for individuals and communities. Nurses are the coordinators of care for patients and communities, and nursing goals continue to change and develop as society progresses.

Role of the Nurse

The role of the professional nurse is multifaceted and dynamic. Nurses provide direct patient care, educate

individuals and families, act as advocates, coordinate care, and provide leadership and change within the healthcare system. They play a crucial role in promoting health, delivering holistic care, and improving patient outcomes.

LINK TO LEARNING

Watch a brief video featuring nurses of different backgrounds (https://openstax.org/r/77NurseBackgVid) as they speak about the various aspects of the role of the nurse.

Health Promotion

The nurse's role in **health promotion** is centered around empowering individuals, families, and communities to take control of their well-being and make positive choices (Burke, 2023a). Nurses provide education, guidance, and support to promote healthy lifestyles, prevent illness, and enhance overall wellness. They assess individuals' health needs, identify risk factors, and develop personalized plans to promote optimal health. Nurses also collaborate with other healthcare professionals and community organizations to create strategies for health promotion, such as conducting health screenings, offering counseling services, and advocating for policies that support healthy environments. By fostering a culture of health, nurses play a vital role in empowering individuals to make informed decisions, adopt healthy behaviors, and achieve their highest level of well-being.

Illness Prevention

The nurse's role in illness prevention is to identify potential health risks, educate patients and communities about preventive measures, and implement interventions to reduce the occurrence and impact of diseases (Burke, 2023a). Nurses assess a patient's health status, gather information about their medical history and lifestyle factors, and identify risk factors that could lead to illness. They then provide education on disease prevention strategies such as immunizations, screenings, and other healthy behaviors. Nurses collaborate with individuals, families, and communities to develop personalized prevention plans and support them in making informed choices that promote their well-being. By actively engaging in illness prevention, nurses contribute to reducing the incidence of preventable diseases and improving overall population health.

Restoring Health

The nurse's role in restoring health is to provide care and support to patients experiencing illness or injury (Burke, 2023a). Nurses play a vital part in facilitating the healing process and helping patients regain optimal health and well-being. They bring together their clinical expertise, critical thinking skills, and therapeutic communication to address the physical, emotional, and social needs of patients. Nurses administer treatments, monitor vital signs, manage medications, and perform various interventions to promote recovery. They collaborate with the interdisciplinary healthcare team and educate patients on self-care strategies, rehabilitation exercises, and lifestyle modifications. The nurse's role in restoring health involves creating a healing environment, providing compassionate care, and empowering patients to actively participate in their recovery journey.

Facilitating Coping with Altered Function

One of the nurse's roles is to care for patients and help them and their families adapt to temporary and permanent life changes (Burke, 2023b). Examples include changes in the patients' physical and mental functioning, both short and long term. Illness or injury can seriously affect almost every aspect of a patient's life, and every patient will handle their altered functioning in a different way. The altered functioning might be something short term, such as a patient who had a hip replacement who must now use a walker to ambulate safely for a few weeks. Or, it may be long term or chronic, such as a patient who has had a limb amputated.

The patient's ability to institute, maintain, and regain psychological homeostasis when this homeostasis is disrupted for one reason or another is called **coping strategy**. There are many ways in which a nurse can assess how a patient is coping with their altered functioning, including the following:

- Assessing the patient's support systems and available resources.
- Assessing the patient's ability to adapt to temporary/permanent role changes.
- Assessing the patient's reaction to a diagnosis of acute or chronic mental illness (e.g., rationalization, hopefulness, or anger).
- Assessing the patient's coping skills for navigating life changes and provide support when needed.

- Identifying situations that may necessitate role changes for a patient (e.g., spouse with chronic illness or death of parent).
- Providing support to the patient with unexpected altered body image (e.g., trauma-related limb amputation).
- Evaluating the constructive use of defense mechanisms by a patient.
- Evaluating whether the patient has successfully adapted to situational role changes (e.g., accept dependency on others).

A **coping strategy** is an action, a series of actions, or thought processes used in meeting a stressful or unpleasant situation or in modifying one's reaction to such a situation. Coping strategies are classified as adaptive or maladaptive. An **adaptive coping** strategy includes problem-focused coping and emotion-focused coping. The **problem-focused coping** strategy typically focuses on seeking treatment such as counseling or cognitive behavioral therapy. The **emotion-focused coping** strategy includes mindfulness, meditation, and yoga; using humor and jokes; seeking spiritual or religious pursuits; engaging in physical activity or breathing exercises; and seeking social support. A **maladaptive coping** response includes avoidance of the stressful condition, withdrawal from a stressful environment, disengagement from stressful relationships, and misuse of drugs and/or alcohol (Amnie, 2018).

Nurses can educate individuals and their family members about adaptive, emotion-focused coping strategies and make referrals to interdisciplinary team members for problem-focused coping and treatment options for individuals experiencing maladaptive coping responses to stress. Some of these positive strategies include

- positive reframing with techniques such as the appropriate use of humor;
- positive self-talk;
- utilizing the help of social supports;
- utilizing community resources that are appropriate to the patient's needs;
- learning and using new and more effective coping skills, problem solving skills, and decision-making skills;
- the use of relaxation and stress management techniques, such as meditation, yoga, or journaling; and
- readjusting and setting expectations of self that are achievable and realistic as based on the patient's current state or status.

Ethical Principles of Nursing

The ANA's ethical principles serve as a crucial foundation for nursing practice, guiding nurses in ethical decision-making and ensuring the provision of high-quality, patient-centered care (Burke, 2023c). An ethical principle is a general guide, basic truth, or assumption that can be used with clinical judgment to determine a course of action. These seven principles provide a framework that upholds the values and ethical standards of the nursing profession.

- **Accountability** involves taking responsibility for one's own actions and accepting all consequences, both personal and professional, that can result from these actions.
- **Autonomy** is respecting the right of patients to make their own decisions and participate in their care. Nurses support patients in making informed choices while considering their values, beliefs, and capacity to understand.
- **Beneficence** is acting in the best interest of patients and promoting their well-being. Nurses strive to provide interventions and care that maximize positive outcomes and minimize harm.
- **Fidelity** is demonstrating faithfulness, loyalty, and commitment to patients. Nurses establish trusting relationships, maintain confidentiality, and uphold professional standards to ensure the trust and confidence of patients and the public.
- **Justice** is maintaining fairness and equity in health care. Nurses advocate for equal access to healthcare services, fair allocation of resources, and equitable treatment of all patients, regardless of their background or circumstances.
- **Nonmaleficence** is avoiding harm and preventing or minimizing potential risks to patients. Nurses uphold the principle of "do no harm" by carefully assessing and managing potential risks, and taking necessary precautions to protect patients.
- **Veracity** is honesty and truthfulness in communication. Nurses are transparent and provide accurate information to patients, respecting their right to be fully informed about their health condition, treatment options, and potential outcomes.

Principles of Clinical Judgment

The purpose of nursing clinical judgment measurement model (CJMM)s is to provide a structured framework that guides nurses in developing and applying their clinical judgment skills and knowledge. These models aim to enhance nurses' critical thinking abilities, improve their decision-making processes, and promote consistent and evidence-based nursing practice.

Clinical judgment models provide nurses with a systematic approach to collecting and analyzing patient data, identifying patterns and trends, and making informed clinical decisions. These models typically involve a series of steps that nurses can follow to ensure a comprehensive and logical thought process. By utilizing clinical judgment models, nurses can enhance their ability to recognize and interpret complex patient situations, anticipate potential problems, and implement appropriate interventions. These models also facilitate effective communication and collaboration with other healthcare professionals, as they provide a shared language and structure for discussing patient care.

Moreover, nursing clinical judgment models help bridge the gap between theoretical knowledge and practical application. They encourage nurses to integrate evidence-based practice, clinical expertise, and patient preferences in their decision-making, resulting in improved patient outcomes and a higher quality of care.

CLINICAL JUDGMENT MEASUREMENT MODEL

National Council of State Boards of Nursing (NCSBN) and the Six Steps of the Clinical Judgment Measurement Model (NCJMM)

The Clinical Judgment Measurement Model (NCJMM) was developed by the National Council of State Boards of Nursing (NCSBN) to provide a standardized framework for assessing and enhancing clinical judgment skills in nursing practice. It addresses the need for a structured approach to evaluate nurses' decision-making abilities and promote safe and effective patient care. By guiding the measurement and development of clinical judgment, the NCJMM contributes to improved nursing education, research, and practice, ultimately leading to better patient outcomes.

The six steps of the NCJMM consist of the following:

1. Cue recognition: Identifying relevant cues or information from the patient's situation and healthcare environment.
2. Pattern recognition: Recognizing patterns or relationships among the cues to form a meaningful understanding of the situation.
3. Problem representation: Clearly defining and articulating the nature and significance of the identified problem or clinical situation.
4. Hypothesis generation: Generating possible hypotheses or alternative explanations to explain the problem and guide further assessment and intervention.
5. Hypothesis evaluation: Evaluating the hypotheses through a systematic analysis of the available evidence and data, considering their validity and applicability.
6. Final judgment: Making a clinical judgment or decision based on the evaluation of hypotheses and selecting the most appropriate course of action for the patient's care.

These steps provide a structured framework for nurses to navigate the complex process of clinical judgment and decision-making in their practice (NCLEX, 2023).

There are many traditional models of clinical judgment. One of the best known is Tanner's clinical judgement model (Mann, 2018), which includes four major components: noticing, interpreting, responding, and reflecting (Figure 1.3). This model provides a framework for assessing and evaluating the clinical judgment skills of both novice and experienced nurses. Its purpose is to focus on capturing the essential elements of clinical judgment that nurses should possess in order to make sound decisions in complex patient-care situations in order to provide valuable feedback.

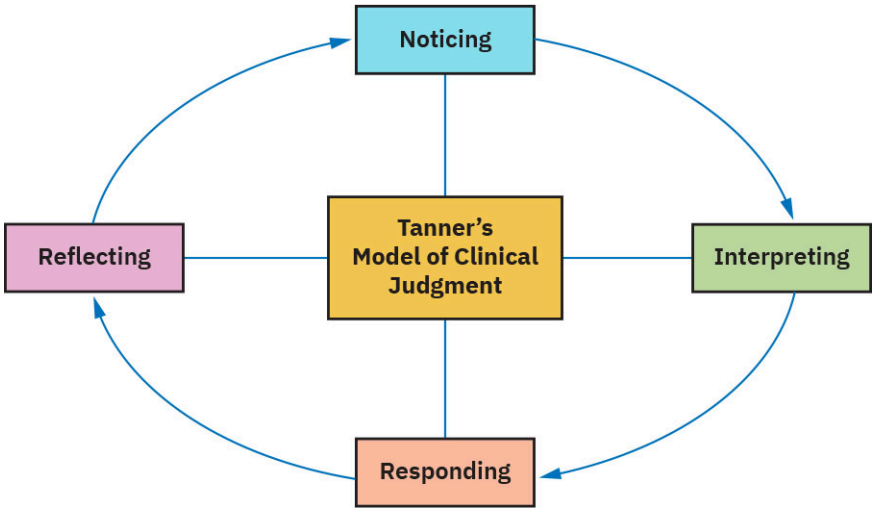

FIGURE 1.3 Tanner's clinical judgment model focuses on the basic skills a nurse needs for sound clinical judgment. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Noticing

The noticing component of Tanner's clinical judgment model is a critical aspect of the clinical reasoning process in nursing (Mann, 2018). It involves the nurse's ability to gather and attend to relevant cues or information from the patient's situation and the healthcare environment. Noticing is more than simply observing; it requires an active and deliberate focus on key details that are significant to the patient's health status.

During the noticing phase, nurses gather data through observation, assessment, and interaction with the patient, family, and physical environment. They rely on their clinical knowledge and experience to recognize patterns, identify deviations from normalcy, and notice any potential problems or changes in the patient's condition. This can include physical signs, symptoms, nonverbal communication, patient statements, and changes in vital signs. Effective noticing requires keen observation skills, active listening, and an awareness of the context in which care is being provided. For example, a nurse may have a patient with pneumonia who is calmly sitting in bed and states that they "feel fine" when asked. However, their oxygen saturation is only 89 percent on room air, and when the nurse auscultates the patient's lungs, they hear crackles. Even though the patient stated that they felt fine, the nurse noticed other abnormal signs, including vital signs and physical signs, that needed addressing.

Interpreting

The interpreting data component of Tanner's clinical judgment model is a critical step in the clinical reasoning process. After gathering relevant cues and data from the patient's situation, the nurse must make sense of the information to develop a meaningful understanding of the patient's health status (Mann, 2018).

During the interpretation phase, nurses analyze and synthesize the collected data from the noticing phase, connecting the dots to identify patterns, relationships, and potential implications for the patient's condition. This process involves comparing the collected information with their knowledge base and clinical expertise.

Interpreting data requires critical thinking skills, including the ability to differentiate between significant and insignificant information, identify potential cause-and-effect relationships, and consider the contextual factors influencing the patient's health. Nurses must consider the patient's unique circumstances, such as their medical history, personal preferences, and cultural background, when interpreting the data. Effective interpretation of the data collected allows nurses to develop hypotheses or possible explanations regarding the patient's health status and the underlying factors contributing to their condition. It enables the nurse to formulate educated guesses about the possible diagnoses, problems, or areas of concern that need further exploration or intervention.

Responding

The responding component of Tanner's clinical judgment measurement model (CJMM) involves the nurse's ability to develop and implement appropriate actions or interventions based on the interpretation of the collected data and the identified patient needs (Mann, 2018). During the responding phase, nurses utilize their clinical knowledge, expertise, and evidence-based practice to generate a range of possible actions or interventions to address the

patient's health condition. They prioritize the interventions based on the urgency and significance of the identified problems or needs.

Responding also involves effective communication and collaboration with the healthcare team and the patient. Nurses engage in therapeutic interactions with patients, providing education, support, and guidance to help them understand and participate in their care. Nurses must advocate for the patient's preferences, rights, and autonomy, ensuring that the interventions are tailored to the patient's unique circumstances.

Nurses implement the planned interventions with attention to safety, quality, and ethical considerations. Interventions can range widely from clinical care, to mental and spiritual support, to assistance navigating the healthcare system. In this phase, nurses administer medications, perform treatments, provide emotional support, facilitate patient education, and coordinate care services. The nurse's response should be aligned with evidence-based practice, reflecting the best available research and clinical guidelines.

Throughout the responding phase, nurses continually assess the patient's response to the interventions and make necessary adjustments or modifications to the plan of care. They monitor the patient's condition, evaluate the effectiveness of the interventions, and document the outcomes and any changes in the patient's health status. The responding component then proceeds to the reflection stage, although nurses continuously observe and gather new cues to refine and adapt their responses throughout the care process.

Reflecting

The reflecting component of Tanner's clinical judgement model involves the nurse's ability to engage in self-assessment, introspection, and critical reflection on their own thinking, actions, and decision-making throughout the patient care experience (Mann, 2018). During the reflecting phase, nurses pause and examine their own thoughts, assumptions, biases, and feelings that may influence their clinical judgment. They reflect on their performance, seeking to understand their strengths and areas for improvement. This introspective process allows nurses to develop a deeper understanding of their own clinical reasoning abilities and to refine their practice.

Reflecting also involves considering the outcomes of the interventions and evaluating their effectiveness in achieving the desired patient outcomes. Nurses examine the impact of their decisions and actions on the patient's well-being, and they are able to critically analyze any discrepancies between the expected and actual outcomes. They reflect on interdisciplinary collaboration, communication, and teamwork within the healthcare team, identifying areas for improvement in future situations.

Through reflective practice, nurses continually learn and grow as professionals. They may actively seek feedback from colleagues, patients, and other members of the healthcare team to gain different perspectives and improve their clinical judgment skills. Reflecting also allows nurses to identify patterns or trends in their clinical decision-making, leading to enhanced future performance and more refined clinical judgment. By engaging in critical reflection, nurses enhance their self-awareness, improve their clinical reasoning abilities, and promote professional growth. It fosters a culture of continuous improvement, ensuring that nurses are continually learning from their experiences to provide the best possible care for their patients.

1.2 Evidence-Based Practice

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Analyze how different theories influence nursing knowledge
- Describe how nursing research has evolved
- Identify the steps for translating evidence-based research into evidence-based practice

This section will explore the world of nursing theory and how it has shaped evidence-based practice (EBP) and the nursing profession as a whole. As nursing evolved from reliance on complete medical direction into independent professional practice, nursing theories were developed by leaders in the field to shape nursing practice into what it is today. This section will guide you through these important aspects, helping you grasp the connections between theory, research, and practice.

Interdisciplinary Theories Used in Nursing

A theory that integrates knowledge and concepts from one or more disciplines to enhance nursing practice, research, and education is known as an interdisciplinary theory. These are an essential part of nursing as they provide a broader perspective and more comprehensive understanding of healthcare issues.

In nursing, interdisciplinary theories are used in various ways. They assist in the development of nursing models and frameworks that guide the delivery of patient care. By incorporating theories from disciplines such as psychology, sociology, and biology, nurses can better understand the complex factors influencing health and apply holistic approaches to patient care.

Interdisciplinary theories also facilitate collaboration among healthcare professionals from various disciplines. Nurses frequently work as part of interdisciplinary teams, including physicians, therapists, social workers, and others. By understanding and integrating theories from different fields, nurses can effectively communicate and collaborate with team members, promoting coordinated and holistic patient care.

General Systems Theory

The **general systems theory** is a conceptual framework that describes how systems function and interact with their environment (American Psychological Association, 2023). General systems theory views the world not as a collection of individual elements operating independently, but as a network of interconnected systems. A **system** is defined as a set of elements that are interrelated and work together to achieve a common goal. An **element** can be an object, person, process, or concept. General systems theory emphasizes the interdependence, relationships, and dynamics within and between systems.

General systems theory is highly beneficial in healthcare settings as it provides a holistic perspective and promotes a comprehensive understanding of complex healthcare systems. It encourages healthcare professionals to view the entire system, including patients, healthcare providers, and community resources, as interconnected components. By adopting a systems thinking approach, healthcare teams can analyze the relationships and interdependencies within the system, identify patterns, and address underlying causes of problems.

Adaptation Theory

Roy's adaptation model, developed by nursing theorist Sister Callista Roy, is a conceptual framework based on the belief that individuals strive to maintain balance and achieve a state of equilibrium in response to changes in their internal and external environments, and aims to promote adaptation for optimal health and well-being (Marudhar & Josefina, 2019).

According to Roy's adaptation model, adaptation is influenced by both internal and external stimuli. An **internal stimulus** includes physiological, psychological, and cognitive factors, while an **external stimulus** encompasses the physical, social, and cultural aspects of the environment.

Roy's model proposes four major adaptive modes: physiological, self-concept, role function, and interdependence. These adaptive modes represent different aspects of an individual's life and are interconnected (Figure 1.4). The model also highlights the importance of coping strategy mechanisms and the role of the nursing profession in facilitating adaptive responses.

Nurses using Roy's adaptation model assess individuals' adaptive responses, identify stimuli that may disrupt adaptation, and intervene to promote adaptation. Interventions may include modifying the environment, providing education and support, or assisting individuals in developing effective coping strategies. See 1.1 Principles of Nursing Practice for a more detailed description of strategies that nurses can give to their patients to help promote adaptation and adapt effective coping strategies.

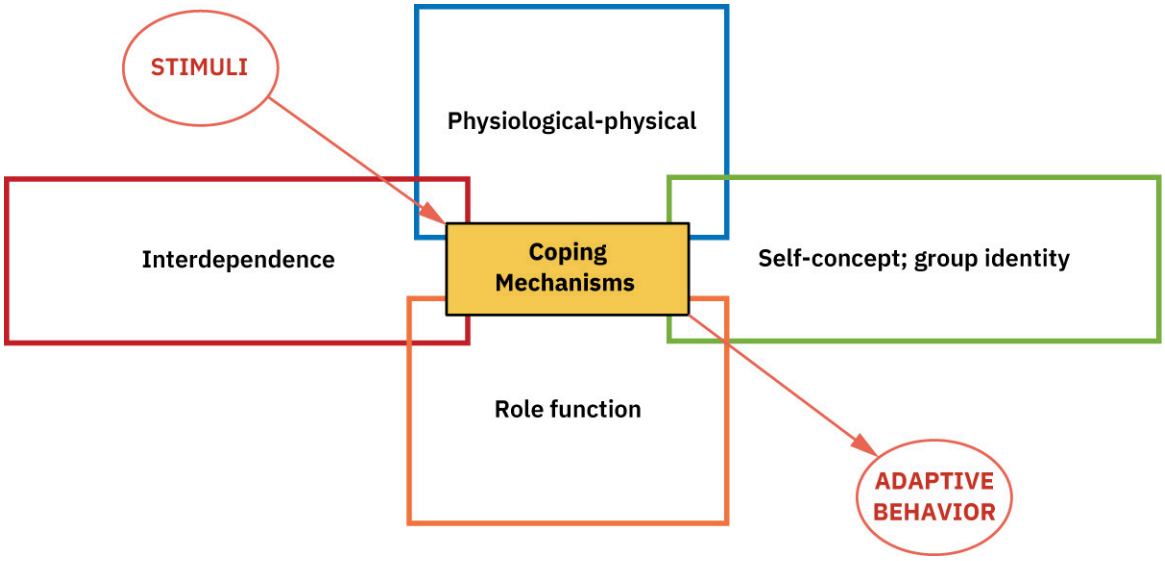

FIGURE 1.4 Roy's adaptation model shows how different aspects of an individual's life determine adaptability. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Developmental Theory

A **developmental theory** is a framework that aims to explain and understand how individuals grow, change, and develop across various stages of life, emphasizing the interaction between biological, cognitive, social, and emotional factors in shaping human development. Erik Erikson's psychosocial development theory and Abraham Maslow's hierarchy of needs theory are two of the most important developmental theories that have influenced nursing theory.

Erikson's psychosocial development theory outlines eight stages of human development, each characterized by a unique psychosocial crisis or challenge (Orenstein & Lewis, 2022). These stages span from infancy to old age and emphasize the importance of successfully resolving these crises for healthy psychosocial development (Figure 1.5). Nursing theories influenced by Erikson's model recognize the significance of addressing psychosocial aspects of patient care, such as identity, intimacy, and generativity. These theories focus on promoting patients' psychological well-being, fostering positive relationships, and supporting patients in their developmental journeys. Examples include Jean Watson's caring science and human caring theory, Imogene King's theory of goal attainment, and Betty Neuman's systems model.

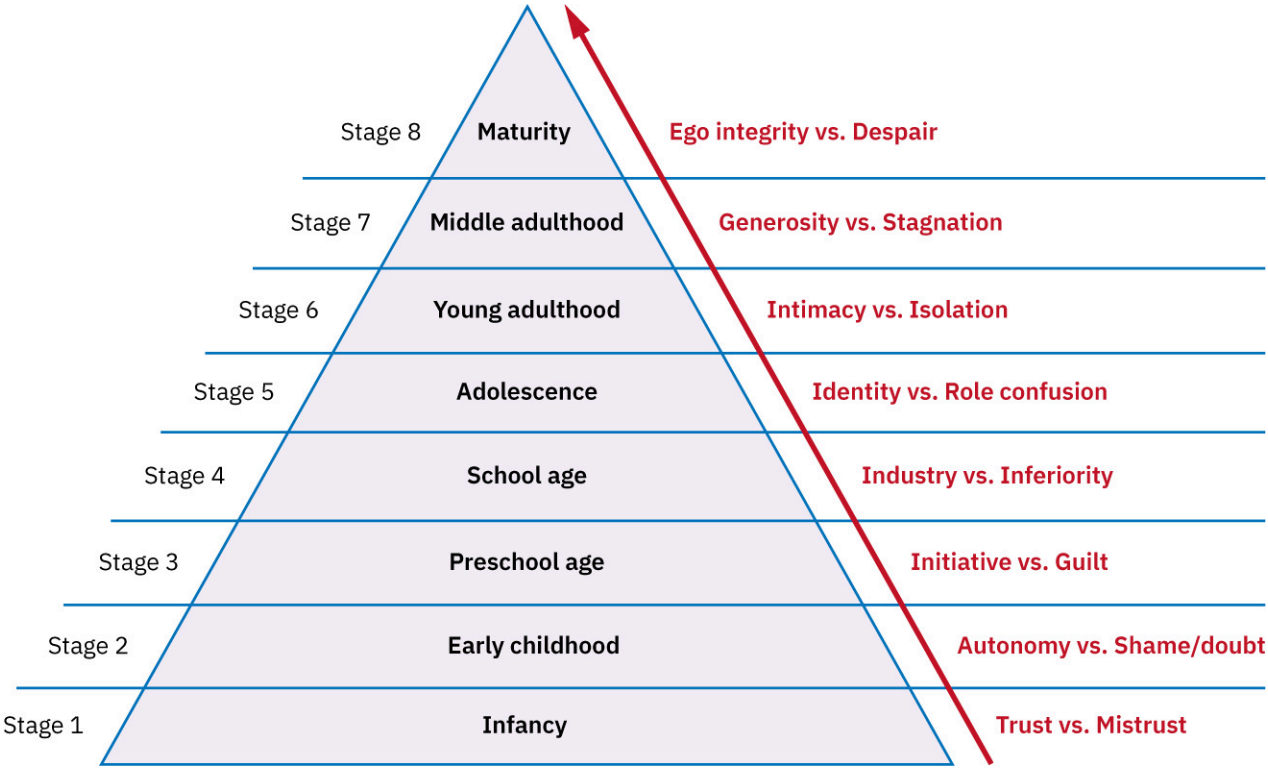

FIGURE 1.5 Erik Erikson's stages of psychological development show the different psychosocial crisis or challenge presented at every stage of life. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

On the other hand, **Maslow's hierarchy of needs theory** posits that individuals have a hierarchical structure of needs, ranging from basic physiological needs to self-actualization (Toney-Butler & Thayer, 2023). This theory suggests that individuals must fulfill their basic physiological and safety needs before progressing to higher-level needs such as belonging, self-esteem, and self-actualization. Nursing theories inspired by Maslow's model prioritize providing holistic care that addresses patients' physiological, psychological, and social needs. Examples include Hildegard Peplau's theory of interpersonal relations, Virginia Henderson's nursing theory, Madeleine Leininger's culture care theory, and Sister Callista Roy's adaptation model.

These theories emphasize the importance of creating a supportive and nurturing environment that promotes patients' well-being and enables them to reach their full potential. Figure 1.6 depicts Maslow's hierarchy and illustrates the various human needs encompassed by holistic care.

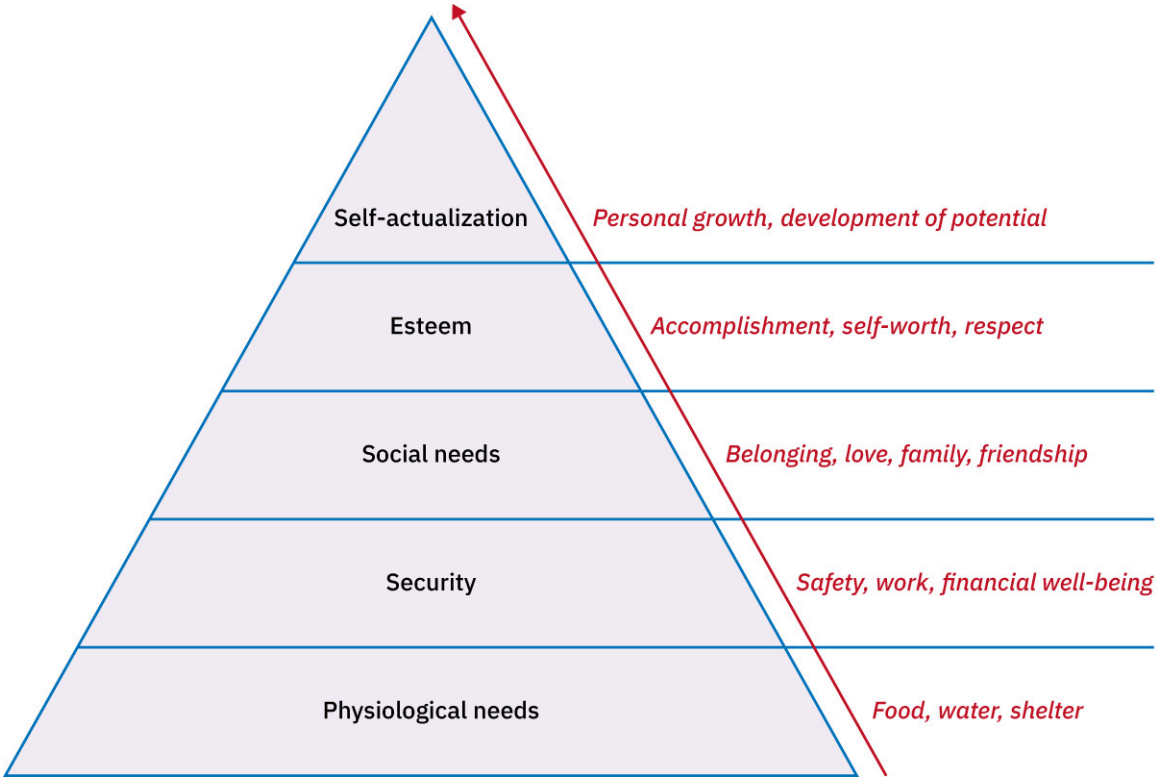

FIGURE 1.6 According to Maslow, food and water are among the most basic human needs; they must be met before people can fulfill needs higher in the hierarchy. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Both Erikson's and Maslow's theories have influenced nursing theorists in recognizing the importance of addressing the multidimensional needs of patients. They have contributed to the development of nursing theories that embrace a holistic perspective, acknowledging the influence of psychological, social, and developmental factors on patients' health and well-being.

Nursing Theory

The **nursing theory** refers to a set of organized concepts, principles, and relationships that guide and inform nursing practice. It is a systematic and evidence-based framework developed by nursing theorists to describe, explain, predict, and prescribe nursing care. Ultimately, nursing theories shape how nurses interact with their patients.

Framework of Nursing Theory

The **framework of nursing theory** provides a structured and organized approach to understanding and applying nursing concepts and principles. It serves as the foundation (Table 1.1) upon which nursing theories are built and helps to organize and categorize nursing knowledge.

Key Components of Nursing Theory Framework	Definition
Concepts	Concepts are the building blocks of nursing theory. They are abstract ideas or phenomena that represent various aspects of nursing practice and patient care. Examples of nursing concepts include health, environment, nursing process, adaptation, and caring.
Propositions	Propositions are statements that describe the relationships between concepts within a nursing theory. They articulate the connections and interactions between different elements of the theory and provide a basis for understanding and explaining nursing situations.
Assumptions	Assumptions are underlying beliefs or values that guide the development and application of nursing theory. They are the foundation upon which theories are built and shape the perspective and approach of the theory. Assumptions may relate to the nature of health, the role of the nurse, or the influence of the environment, among others.
Models or frameworks	Some nursing theories are presented in the form of models or frameworks that provide a visual representation of the theory's key concepts, relationships, and processes. These models or frameworks offer a visual guide for understanding and applying the theory in practice.

TABLE 1.1 Key Components and Definitions of Nursing Theory Framework

The framework of nursing theory is dynamic and evolves as new knowledge and evidence emerge. Nursing theories and their frameworks contribute to the development of EBP, improve patient outcomes, and enhance the professional identity and autonomy of the nursing profession. There are two main types of nursing theories: descriptive and prescriptive.

Descriptive Theories

A **descriptive theory** in nursing, also known as phenomenological theories, focuses on describing and understanding the lived experiences of individuals in the context of health care (Watkins, 2020). These theories aim to provide a deeper understanding of the meaning and significance of various phenomena related to health, illness, and nursing care.

Descriptive nursing theories often employ qualitative research methods to explore and analyze the subjective experiences, perspectives, and perceptions of patients, families, and healthcare providers. They seek to uncover the essence of these experiences and the underlying meanings attributed to them. These theories may explore topics such as the experience of chronic illness, the process of decision-making in health care, the impact of cultural beliefs on health behaviors, or the challenges faced by nurses in providing end-of-life care. They delve into the lived experiences of individuals to gain insights into the complexity and nuances of healthcare phenomena.

Leininger's theory of culture care diversity and universality is an example of a descriptive nursing theory. This theory focuses on describing the impact of cultural beliefs, values, and practices on health and nursing care (McFarland & Wehbe-Alamah, 2019). It explores how individuals from different cultural backgrounds experience and perceive health, illness, and health care, highlighting the importance of cultural competence in nursing practice.

Prescriptive Theories

A **prescriptive theory** in nursing provides guidance and direction for nursing practice by offering recommendations, interventions, or guidelines to achieve desired outcomes (Watkins, 2020). These theories focus on prescribing actions or strategies that nurses can implement to promote health, prevent illness, and facilitate healing. One example of a prescriptive nursing theory is **Watson's theory of human caring**. Watson's theory emphasizes the significance of caring in nursing practice (Watson Caring Science Institute, 2023). It prescribes that nurses should demonstrate genuine caring attitudes, compassion, and empathy toward patients. Nurses then integrate caring behaviors into their interactions, creating a healing environment that nurtures the physical, emotional, and spiritual

well-being of patients.

Concepts of Nursing Theories

The **nursing metaparadigm** refers to the four foundational concepts that are central to the discipline of nursing (Deliktas et. al, 2019). These concepts are person, environment, health, and nursing. They form the overarching framework that guides nursing theory, research, and practice (Figure 1.7). The nursing metaparadigm guides nurses in understanding the interconnectedness of the person, environment, health, and nursing, and serves as a foundation for delivering patient-centered and evidence-based care.

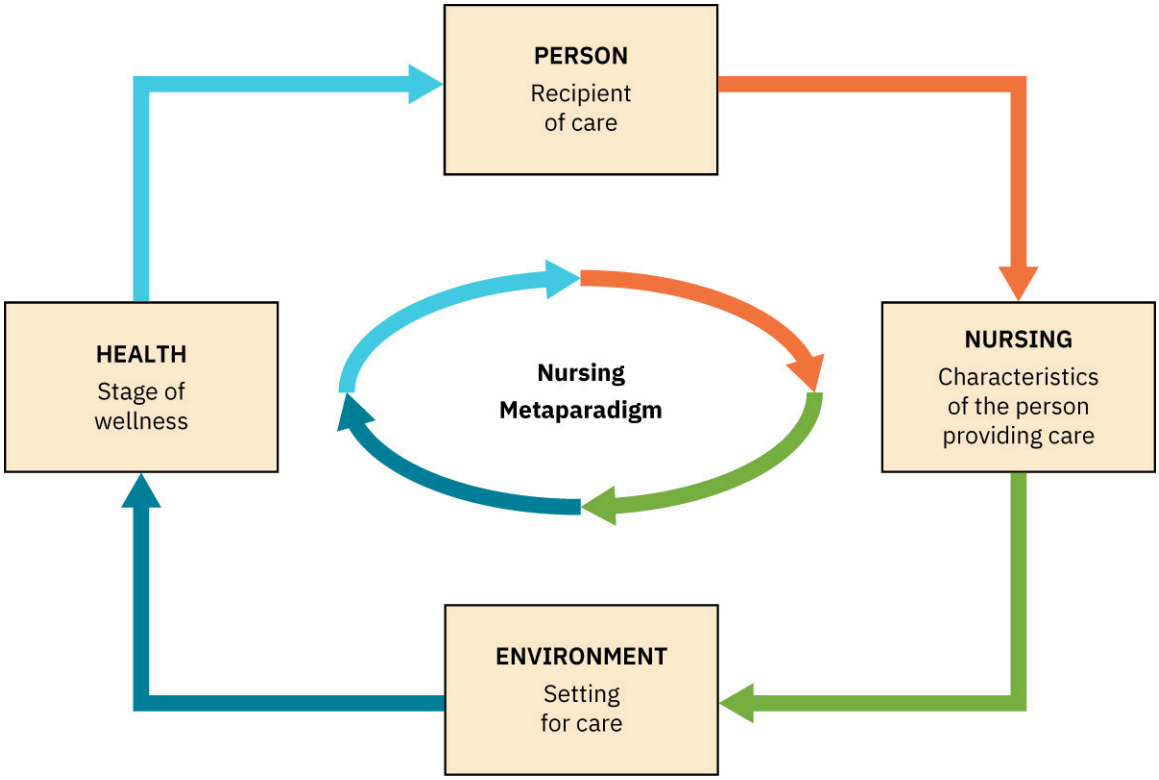

FIGURE 1.7 The four concepts of the nursing metaparadigm are interconnected and provide the foundation for effective patient care. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Person

The person refers to the individual, family, group, or community receiving nursing care. It recognizes that each person is unique, with physical, emotional, social, and spiritual dimensions. Nurses support the concept of person by considering the patient's beliefs, values, and preferences when developing a plan of care.

Environment

The environment encompasses the physical, social, cultural, and economic settings in which the person exists. It includes both the immediate healthcare setting and the broader societal and environmental factors that can influence health outcomes. Nurses support the concept of environment by recognizing the impact of the environment on the patient's well-being and working to create a supportive, safe, and healing environment.

Health

Health encompasses the physical, mental, and social well-being of the person. It goes beyond the absence of illness and emphasizes optimal functioning and quality of life. Nurses support the concept of health by providing education and preventive care, managing symptoms, and facilitating the person's overall well-being.

Nursing

Nursing is the art and science of providing care to individuals, families, communities, and populations. It involves the application of knowledge, skills, and compassion in promoting and maintaining health, preventing illness, and supporting individuals in their healing processes. Nursing is characterized by utilizing a unique body of knowledge, ethical principles, and commitment to provide holistic care.

Evolution of Nursing Research

Nursing research has undergone significant evolution over time, transitioning from a tradition-based practice to a scientifically rigorous discipline. Initially, nursing relied on personal experience and tradition, but beginning in the nineteenth century, the need for evidence-based practice became evident (U.S. Department of Health and Human Services, n.d.). The term **evidence-based practice (EBP)** refers to the integration of the best available research information, clinical expertise, and patient preferences or values to guide healthcare decision-making and improve patient outcomes (American Nurses Association (ANA), 2023). With the establishment of research organizations and journals, nursing research gained recognition and contributed to the improvement of patient care. The adoption of different kinds of research methodologies allowed for more robust investigations into nursing education, practice improvement, and patient outcomes. The emergence of EBP (Table 1.2) further integrated research findings into nursing practice, ensuring that decisions are based on the best available evidence. Nursing research has expanded its focus to encompass diverse topics such as chronic illness management, mental health, and healthcare disparities. Technological advancements and interdisciplinary collaborations continue to shape the evolution of nursing research, further advancing the field and its impact on patient care.

ANA Standard 13, Evidence-Based Practice and Research
The ANA's Standards of Professional Performance are a set of guidelines that outline the behaviors and competencies expected of nurses in their professional roles. These standards encompass various domains, including quality of care, professional practice evaluation, education, collaboration, ethics, research, resource utilization, leadership, and advocacy.
Standard 13, Evidence-Based Practice and Research, states "the registered nurse integrates evidence and research findings into practice" (American Nurses Association, 2021).
The ANA Standard 13 on Evidence-Based Practice and Research is an indispensable cornerstone of nursing practice. This standard is paramount because it emphasizes the integration of the best available evidence into clinical decision-making. By adhering to Standard 13, nurses are equipped with the tools to critically appraise research, identify relevant findings, and translate them into evidence-based interventions. This elevates nursing practice by ensuring that patient care is grounded in scientifically sound principles. Moreover, embracing evidence-based practice fosters a culture of lifelong learning and professional growth. By implementing this standard, nurses become steadfast advocates for quality and safety, driving the delivery of patient-centered care.

TABLE 1.2 ANA Standard 13

Protection of Human Rights in Nursing Research

The protection of human rights is of utmost importance in nursing research to ensure the ethical treatment of participants and uphold their dignity, privacy, and well-being (Burke, 2023c). Several principles and guidelines are in place to safeguard human rights during the research process:

- Informed consent: Obtaining **informed consent** is a fundamental requirement in nursing research. Participants must be provided with comprehensive information about the study, including its purpose, procedures, risks, benefits, and their right to withdraw at any time. Informed consent ensures that individuals can make voluntary and autonomous decisions about their participation.
- Confidentiality and privacy: The ethical and legal duty to safeguard and protect sensitive and private information from unauthorized disclosure or access, ensuring it remains secure from others is known as **confidentiality**. Respecting the confidentiality and privacy of research participants is crucial. Nurses must take measures to protect participants' identities and ensure that data are handled securely. Confidentiality allows individuals to share sensitive information without fear of it being disclosed to unauthorized individuals.
- Beneficence and nonmaleficence: Nursing researchers have an ethical obligation to promote the well-being of participants (beneficence) and minimize any potential harm (nonmaleficence). This includes carefully designing research protocols, minimizing risks, and monitoring participants' welfare throughout the study.
- Research ethics committees: Institutional review boards or research ethics committees play a vital role in safeguarding human rights in nursing research. These committees review research protocols to ensure that

ethical principles are upheld, participants' rights are protected, and potential risks are minimized.

- At-risk populations: Special considerations must be given when conducting research involving at-risk populations. The term **at-risk population** refers to a group of individuals who are at higher risk of experiencing adverse health, social, or economic outcomes due to various factors such as limited access to resources, socioeconomic disparities, or health conditions. This includes children, older adults, individuals with cognitive impairments, or those with limited decision-making capacity. Extra safeguards are necessary to protect the rights and welfare of these individuals.
- **Ethical guidelines and standards**: Nursing research adheres to ethical guidelines and standards and national regulatory bodies' guidelines. These documents provide ethical frameworks and principles that guide researchers in conducting ethical and responsible research.

By upholding the protection of human rights in nursing research, nurses contribute to the integrity, validity, and ethical conduct of research. Ensuring participants' autonomy, privacy, confidentiality, and overall well-being enhances the trustworthiness of research findings and upholds the ethical principles central to the nursing profession.

LINK TO LEARNING

The U.S. Department of Health and Human Services offers free, comprehensive training on human research protections (https://openstax.org/r/77TrainingHRP) on their website. This training is mandatory for researchers who wish to participate in studies involving human subjects that are funded by the National Institutes of Health (NIH). Certificates can be printed for each lesson to demonstrate completion of the course.

Methodology of Nursing Research

Nursing research methodology uses both quantitative and qualitative research methods (Figure 1.8). The **quantitative research** refers to a systematic and empirical approach that involves the collection, analysis, and interpretation of numerical data to answer research questions and explore phenomena related to health care. Quantitative research provides numerical data and statistical analysis, allowing for objective measurements, generalizations, and statistical significance. It helps identify trends, assess treatment effectiveness, and inform evidence-based practice.

On the other hand, **qualitative research** in nursing refers to a systematic and subjective approach that focuses on understanding and interpreting human experiences, meanings, and social phenomena in the context of health care. Qualitative research explores the subjective experiences, perspectives, and meanings behind healthcare phenomena through in-depth interviews, observations, and narratives. It provides rich, contextual insights into patients' lived experiences, healthcare provider interactions, and social determinants of health. By combining both approaches, nurses can obtain a holistic view of patient care, integrating objective data with the humanistic aspects of health care (Curtis et al., 2016).

Qualitative Questions	Quantitative Questions
Purpose • To explain why or how **Data type** • Subjective and open to interpretation **Approach** • Observation and interviews **Analysis** • Grouping and categorization	**Purpose** • To determine how many or how much **Data type** • Fixed and numerical or statistical **Approach** • Measuring and counting **Analysis** • Statistical analysis

FIGURE 1.8 Nursing research methodology uses both quantitative and qualitative research methods. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Quantitative Research

Quantitative research is a methodical investigation that utilizes statistical analysis and objective measurements to generate numerical findings. Statistical analysis techniques are used to summarize the data, draw conclusions, and test hypotheses. Quantitative research aims to identify patterns, relationships, and associations between variables (Table 1.3). The results of quantitative research are presented using statistical tables, charts, and statistical measures such as means, percentages, correlations, or regression analyses.

Type	Description
Correlational	The researcher aims to identify a relationship between two variables, without any outside influence (extraneous variables). A positive correlation means both variables change in the same direction, a negative correlation means the variables change in opposite directions, and a zero correlation means there is no relationship observed.
Descriptive	The researcher observes and measures variables in order to identify trends, or to understand a population, phenomenon, or situation.
Experimental	The researcher aims to identify the relationship between two or more variables using the scientific method. The researcher has control over the extraneous variable, and can recreate and verify the outcomes.
Quasi-experimental	The researcher aims to identify a relationship between two variables, but participants are placed in random groups (extraneous variables) to compare results.
Survey	The researcher uses surveys to collect information. Cross-sectional surveys are given at any point in time; Longitudinal surveys are given for various durations of time.

TABLE 1.3 **Examples of Quantitative Research Approaches** (Source: Taherdoost, 2022.)

In quantitative nursing research, researchers use data collection instruments, such as surveys, questionnaires, or structured observations, to gather data from a sample or population. The collected data are typically in the form of numerical values or categorical responses. An example of quantitative research would be a hospital giving surveys to patients upon discharge, asking them to rate their experience on a numerical scale of 0 to 10, and then evaluating the responses to see which areas most need improvement.

Qualitative Research

Qualitative research is a methodological approach that emphasizes exploring the depth, complexity, and richness of individuals' perspectives and the social context in which they occur.

In qualitative nursing research, researchers use various data collection methods, such as interviews, focus groups, observations, or document analysis, to gather non-numerical data. The data collected often consist of words, narratives, descriptions, and images that provide a detailed understanding of the participants' experiences, beliefs, and perceptions (Table 1.4).

Type	Description
Ethnography	The researcher is directly involved/immersed in the participant's environment; different data techniques are used to document the behaviors, actions, and events of the research population.
Grounded theory	The researcher observes or studies a population, and then develops a comparative analysis based on studied social interactions and experiences.
Phenomenology	The researcher looks into "lived experiences" of the participants, and focuses on examining why the participant behaved a certain way from the perspective of the participant who experienced it.
Narrative	The researcher strings together a sequence of events, usually from just one or two participants, to create a narrative, or cohesive story.

TABLE 1.4 Examples of Qualitative Research Approaches (Source: Tenny et al., 2022.)

The results of qualitative research are typically presented through rich descriptions, quotes, and narratives that capture the essence of the participants' experiences. An example of a simple qualitative research study may be "the effect of having a designated nursing preceptor on the perceived satisfaction of new nurses." Qualitative research in nursing enables a deeper understanding of the subjective aspects of health care, such as patients' lived experiences, cultural beliefs, and social interactions. It explores the complexities and context in which healthcare phenomena occur, allowing for the exploration of multiple perspectives and uncovering novel insights. It also helps generate hypotheses and inform the development of quantitative research studies.

Understanding the Parts of a Research Article

Understanding the parts of an article is crucial for interpreting and extracting valuable information from scholarly literature. Each section of the article serves a specific purpose and provides essential insights for critical appraisal (Carey et al., 2020). Here's a step-by-step look at how to interpret and analyze each component:

1. Abstract: The abstract serves as a concise summary of the entire article. Pay attention to the research question, key findings, and implications. It provides a quick overview of the study's relevance and helps determine if the article aligns with your information needs.
2. Introduction: The introduction sets the stage for the research. Evaluate the background information provided and the clarity of the research question. Consider how well the authors justify the need for the study and their ability to connect it with existing literature.
3. Methods: Scrutinize the methods section to understand how the study was conducted. Assess the appropriateness of the study design, sample size, data collection methods, and statistical analyses. This section should provide sufficient details to allow for replication and assess the validity of the findings.
4. Results: Thoroughly analyze the results section to grasp the main findings. Examine any statistical analyses, figures, or qualitative descriptions presented. Consider the clarity of the results and the extent to which they support the research question. Assess whether the data analysis methods are appropriate and the results are accurately reported.
5. Discussion: The discussion section is where authors interpret the findings and relate them to existing knowledge. Evaluate the authors' ability to critically analyze the results, address any limitations, and consider alternative explanations. Look for implications for nursing practice, education, or future research that are supported by the findings.
6. Conclusion: The conclusion summarizes the main points of the study. Assess whether the conclusions align with the results and discussion. Consider the authors' ability to synthesize the findings and provide a concise

summary of the study's contributions.

7. References: Review the reference list to identify the sources cited in the article. Assess the credibility and relevance of the references to determine if the authors have relied on reputable sources to support their claims.

Translating Research into Practice

Translating research findings to clinical nursing practice is a crucial process that involves applying evidence-based knowledge to improve patient care and outcomes It begins with critically appraising the research to assess its quality and validity (Titler, 2018). Nurses then consider the relevance and generalizability of the findings to their specific patient population and clinical setting. By integrating research findings with their clinical expertise, nurses can develop strategies for implementation, such as creating guidelines or protocols. Ongoing evaluation and monitoring of the implemented practices help nurses assess their impact on patient outcomes. Lifelong learning and staying up to date with current research ensure nurses remain informed and continue to enhance the quality of care they provide.

Steps of Evidence-Based Practice

Evidence-based practice (EBP) refers to the integration of the best available research evidence, clinical expertise, and patient preferences or values to guide healthcare decision-making and improve patient outcomes (ANA, 2023). According to the ANA, there are five key steps in implementing EBP: ask a clinical question, acquire the evidence, appraise the evidence, apply the evidence, and assess outcomes.

Ask a Clinical Question

The first step in implementing EBP is to formulate clear and focused clinical questions that address specific patient care issues. By framing questions in this format, nurses can identify the specific information needed to guide their practice.

Acquire the Evidence

Once the clinical questions are defined, nurses conduct a thorough search for the best available evidence to answer those questions. This involves accessing reputable databases, journals, and other reliable sources to find relevant research studies, systematic reviews, or clinical guidelines that address the identified clinical issues.

Appraise the Evidence

In this step, nurses critically appraise the quality and validity of the evidence gathered. They assess the methodology, study design, sample size, data analysis, and overall strength of the research. They decide if the information is applicable to the patient. This critical appraisal helps determine the credibility and applicability of the evidence to the clinical context.

When you have gathered all of the necessary evidence, the next step is to evaluate it for quality and validity. But how do you know what evidence is strongest and most applicable to your clinical question?

In the steps of EBP, the hierarchy of evidence refers to a ranking system that classifies different types of research studies based on their reliability and validity. The hierarchy helps healthcare professionals determine the strength and quality of evidence when making clinical decisions. The commonly recognized hierarchy includes systematic reviews and meta-analyses at the top, followed by randomized controlled trials (RCTs), cohort studies, case-control studies, cross-sectional studies, case series, and expert opinions at the bottom. The hierarchy of evidence serves as a guide, with studies higher up being considered more rigorous and providing stronger evidence to inform healthcare practices (Figure 1.9).

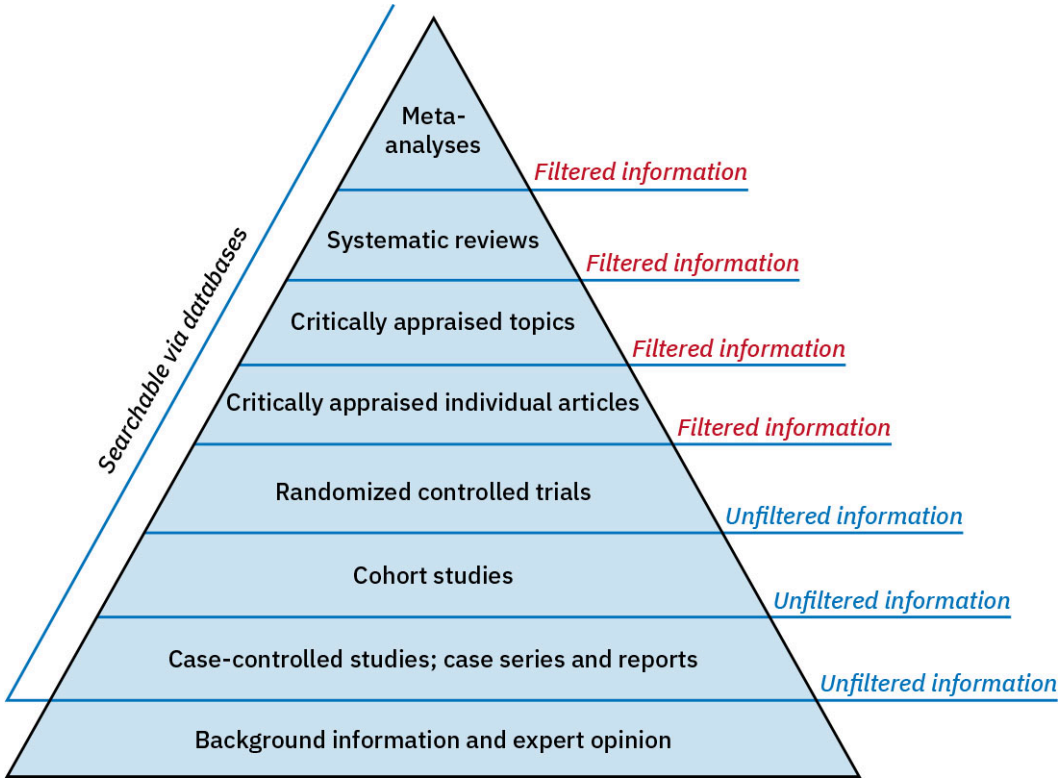

FIGURE 1.9 The pyramid shows the quality of different types of research designs. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Nursing and other healthcare professions also frequently use Melnyk and Fineout-Overholt's levels of evidence (Figure 1.10). Instead of a hierarchy, Melnyk and Fineout-Overholt list seven levels of evidence based on their methodological quality (2023).

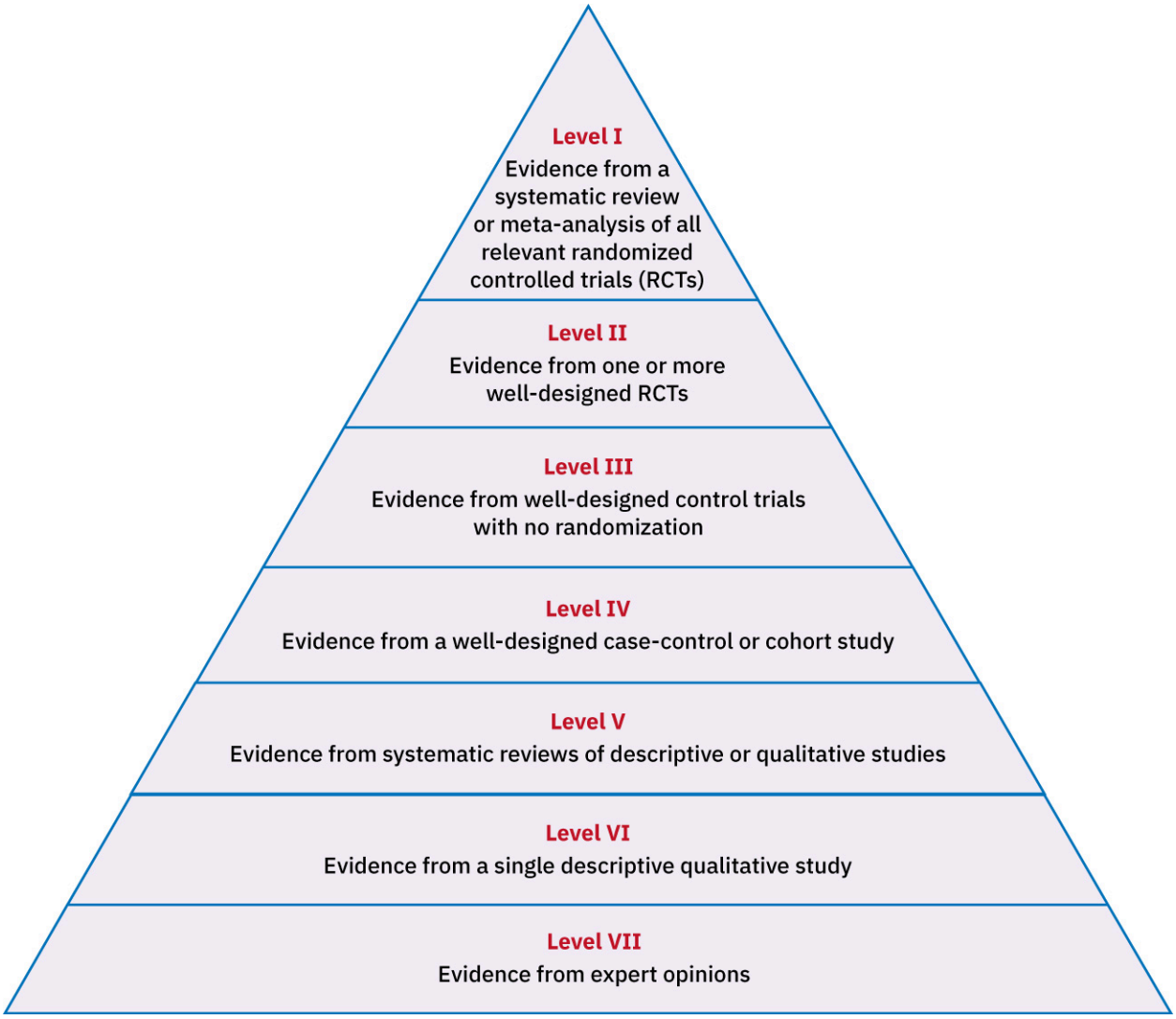

FIGURE 1.10 It is important to note that the position of a study lower on the levels or hierarchy of evidence does not inherently imply a lower strength of recommendation; when evidence from lower levels aligns consistently across studies or is highly persuasive, strong recommendations may still be drawn. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Apply the Evidence

The next step involves implementing evidence-based interventions or changes in practice based on nursing knowledge and new expertise. Nurses integrate the findings from the new evidence with their clinical expertise and knowledge of individual patient values and preferences. They consider factors such as patient preferences, available resources, and feasibility of implementation when making decisions about patient care.

Assess Outcomes

The final stage of implementing evidence-based practices involves evaluating their impact on patient outcomes. Nurses collect data, monitor outcomes, and assess the effectiveness of the implemented interventions. This can help determine if the treatment will be effective for other patients as well. This ongoing evaluation helps identify areas for improvement and supports the continuous cycle of EBP implementation.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Evidence-Based Practice (EBP)

Definition: Provide optimal patient care while integrating best current evidence and expertise with patient/family values and preference.

Knowledge: The nurse will describe reliable sources for locating clinical practice guidelines and evidence, and describe how the strength of evidence influences patient care.

Skill: Provide patient-centered care utilizing current evidence. The nurse will:

- Create individualized care plans based on EBP and patient values.
- Examine evidence reports and research relative to area of expertise.
- Locate evidence related to clinical practice guidelines and topics.
- Engage in the integration of new EBP in the work environment.
- Consult with experts before deviating from EBP.

Attitude: The nurse will recognize the importance of reading professional journals and improving patient care based on new evidence.

1.3 Nursing Process

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the five phases and steps within each phase of the nursing process
- Develop a nursing care plan using diagnoses from evidence-based sources

The nursing process is a dynamic strategy that allows nurses to find pertinent information and use critical thinking to guide patient care. This allows the nurse to receive a quick handoff report from another nurse, and immediately begin providing care to a newly assigned patient. The nursing process becomes a road map for the actions and interventions that nurses implement to optimize their patients' well-being and health. This section will explain how to use the nursing process as standards of professional nursing practice to provide safe, patient-centered care.

Phases and Steps of the Nursing Process

The **nursing process** is a critical thinking model based on a systematic approach to patient-centered care. Nurses use the nursing process to perform clinical reasoning and make clinical judgments when providing patient care. The nursing process is based on the Standards of Professional Nursing Practice established by the ANA. These standards are authoritative statements of the actions and behaviors that all registered nurses, regardless of role, population, specialty, and setting, are expected to perform competently. The mnemonic ADPIE is an easy way to remember the ANA Standards and the nursing process. The five components of the nursing process are: assessment, diagnosis, planning, implementation, and evaluation (Figure 1.11).

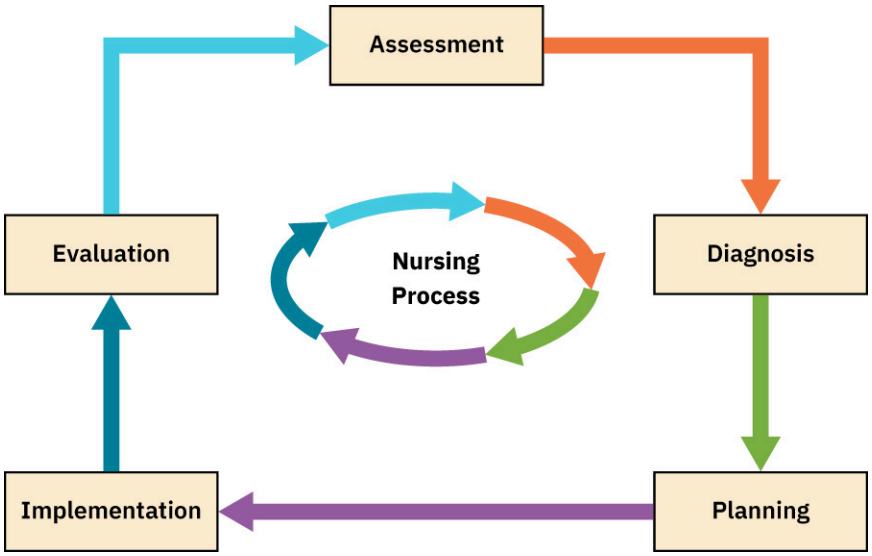

FIGURE 1.11 The nursing process is a critical thinking model based on a systematic approach to patient-centered care. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Assessment

The **assessment** phase involves gathering data about the patient's health status, including physical, psychological, social, and cultural aspects (ANA, 2021). It includes collecting subjective information through interviews and objective data through physical examinations, laboratory tests, and medical records review. This phase sets the foundation for identifying health needs, problems, and strengths.

These assessments can take two primary forms: focused and comprehensive. A **focused assessment** is conducted with a specific purpose in mind, aiming to gather information about a particular health issue or symptom. They are highly targeted and designed to address a specific concern. For instance, if a patient reports chest pain, a nurse would conduct a focused assessment of the cardiovascular system to determine the cause of the discomfort. Focused assessments are instrumental in identifying and addressing immediate health problems.

On the other hand, a **comprehensive assessment** provides a more extensive and detailed overview of a patient's overall health. They encompass physical, psychological, and social aspects of a patient's well-being. These assessments are often performed to establish a baseline of their health status. Comprehensive assessments may be performed upon admission and repeated periodically during a patient's hospital stay, especially in cases of complex conditions, to ensure a holistic understanding of the patient's evolving health needs.

The choice between focused and comprehensive assessments depends on the clinical context and the information required to provide the most effective and appropriate care for the patient. While focused assessments pinpoint specific issues, comprehensive assessments offer a more comprehensive perspective, helping healthcare providers develop comprehensive care plans and monitor overall patient wellness.

Collect Data

This step involves gathering information about the patient's health status through various methods, including interviews, observations, and physical examinations (American Nurses Association (ANA), 2021). Nurses collect both subjective data (information provided by the patient) and objective data (measurable and observable information). They ask relevant questions, such as any current or past medical issues, and current medications that the patient may be taking. They actively listen to the patient's concerns using such strategies as maintaining appropriate eye contact, using open body language, asking clarifying questions, and empathizing. This exchange encourages trust between the nurse and patient and encourages the patient to share information. The nurse also uses their observation skills to identify important cues (Figure 1.12) during the patient's physical assessment and note any abnormal findings.

FIGURE 1.12 A nurse can start an assessment by looking at a patient's appearance and demeanor. (credit: Untitled by U.S. Department of Defense, Public Domain)

CULTURAL CONTEXT

Cultural Considerations during Assessments

In order for nurses to deliver high-quality care to all patients, it is important they understand that cultural factors can influence a patient's behaviors, health beliefs, and reaction to medical issues (Agency for Healthcare Research and Quality, 2020). To build effective relationships with culturally diverse patients nurses should:

- Learn how to interact with diverse patients.
  - Keep an open mind, ask patients about their beliefs, attend cultural competence training, and collaborate with social workers or other cultural experts.
- Provide appropriate learning materials.
- Provide qualified medical translators.
- Strive to build trust.
  - Encourage questions, involve extended family in decision-making, show respect, and utilize culturally inclusive printed materials.

Validate Data

Validation is the process of ensuring the accuracy and reliability of the collected data (ANA, 2021). Nurses compare and cross-reference the information obtained from multiple sources, such as the patient, family members, healthcare team, and medical records. By validating the data, nurses can identify any inconsistencies or discrepancies that may require further clarification or investigation.

Organize Data

Once the data are collected and validated, nurses organize them in a systematic and structured manner. They categorize the information based on body systems, prioritize data based on the patient's immediate needs, and identify significant findings (ANA, 2021). Organizing the data helps nurses to identify patterns, make connections, and recognize potential health problems or risks.

Document Data

Documentation is a crucial step in the assessment process. Nurses record the collected and organized data in a clear, concise, and accurate manner (ANA, 2021). This documentation serves as a legal and communication tool, ensuring that the information is accessible to the healthcare team and providing a comprehensive picture of the patient's health status. Accurate documentation supports continuity of care and enables effective collaboration among healthcare providers.

Diagnose/Analyze Data

In the **diagnosis** phase, nurses analyze and interpret the collected data to identify nursing diagnoses or health problems (ANA, 2021). A **nursing diagnosis** is a clinical judgment based on the medical diagnosis of a patient that help the nurse determine the plan of care. This step helps in identifying specific nursing interventions and developing an individualized plan of care.

LINK TO LEARNING

The North American Nursing Diagnosis Association (NANDA) is a professional nursing organization that researches, develops, disseminates, and refines nursing diagnoses. Visit The Ultimate Guide to Nursing Diagnosis in 2024 (https://openstax.org/r/77NursDiagGuide) to learn more about the different types of nursing diagnoses and how to compose one.

Identify Potential Patient Concerns

In this step, nurses review the gathered data and identify potential health problems or concerns. They critically analyze the information, considering both subjective and objective data, to recognize patterns, deviations from normalcy, and potential risk factors. By applying their clinical knowledge and expertise, nurses develop a list of potential nursing diagnoses that could explain the patient's health issues.

Identify Actual Patient Concerns

In this step, nurses further refine the list of potential nursing diagnoses and identify the actual health problems or concerns that are present in the patient. They critically evaluate the data, considering the patient's specific symptoms, responses, and needs. By prioritizing the identified concerns based on their urgency and significance, nurses establish the actual nursing diagnoses that accurately reflect the patient's current health status.

Apply Data to Clinical Decision-Making

In this final step of the nursing diagnosis phase, nurses utilize the identified nursing diagnoses to guide their clinical decision-making process (ANA, 2021). They use the data gathered during the assessment phase, along with their clinical expertise and EBP, to develop an individualized plan of care. Nurses determine appropriate nursing interventions, establish goals and outcomes, and select strategies to address the identified patient concerns. This step serves as a bridge to the subsequent phases of the nursing process, facilitating the planning, implementation, and evaluation of nursing care.

Planning

In the **planning phase**, nurses collaborate with the patient, their family, and the interdisciplinary healthcare team to set achievable goals or outcomes and develop a comprehensive plan of care (ANA, 2021). The plan outlines specific interventions, strategies, and expected outcomes to address the identified nursing diagnosis. It takes into account the patient's preferences, resources, and cultural considerations.

PATIENT CONVERSATIONS

Planning Care with a Diverse Patient Population

Scenario: The nurse walks into the room of a patient who has just received a breast cancer diagnosis. The patient, Ash, is 36 years old and nonbinary. The purpose of the visit is to collaborate with Ash to develop a plan of care that suits their needs and wants. Ash has a history of distrust of the healthcare system because of bad past experiences, and the nurse helps reassure them that their needs and wishes are at the center of the plan of care.

Nurse: Good morning, Ash. I'm glad you're here today. I understand that you've recently been diagnosed with breast cancer. We're here to discuss your care plan, and I want you to know that your input is extremely valuable. How are you feeling about everything?

Patient: Thanks, Nurse. It's been a rollercoaster of emotions, to be honest. I appreciate your willingness to help, but I've had some bad experiences with health care in the past. I'm worried that people won't listen to me, and that my opinion won't be taken into account, and it's causing me a lot of anxiety.

Nurse: I'm really sorry to hear that, Ash. I understand where your concerns are coming from. Your comfort and preferences are absolutely our priority, and I'm here to make sure your care plan respects your wishes. Could you tell me more about the past experiences that worry you?

Patient: Thanks for understanding. Well, in the past, I've felt like I didn't have a say in my treatment, and it left me feeling uncomfortable and unheard. It was like other people were making decisions they thought were best for me without having any idea who I really am and what I want. I just want to be a part of the decision-making process and not feel pressured into something I might regret.

Nurse: I appreciate your honesty, Ash. Your voice matters, and in this care plan, you'll have a say in every decision. We'll discuss all your treatment options, goals, and outcomes in detail and you'll be fully involved in the process. No pressure, just informed choices.

Patient: That's a relief to hear. I also have some specific preferences regarding my care. I'd really like a gender-neutral and affirming environment, and it's crucial for me to maintain my privacy and dignity throughout this journey.

Nurse: Your preferences are incredibly important, Ash. We're committed to providing a welcoming and affirming atmosphere. Privacy and dignity are non-negotiable, and we'll work together to ensure you feel comfortable at all times. Your gender identity will be respected, and your needs will be met.

Patient: Thank you, Nurse. I'm feeling more at ease already.

Nurse: You're very welcome, Ash. Your well-being is our top priority, and we're here to make this journey as smooth as possible. Feel free to ask questions, share your concerns, or just chat anytime.

Patient: I really appreciate that.

Nurse: That's what we're here for, Ash. We're a team, and your needs will guide our care plan. Don't hesitate to reach out for anything you need along the way. Your comfort and well-being matter deeply to us.

Establish and Prioritize Patient Outcomes

In this step, nurses work collaboratively with the patient, their family, and the healthcare team to establish desired outcomes or goals that reflect the expected changes or improvements in the patient's health. These outcomes should be specific, measurable, attainable, relevant, and timely (SMART) (Figure 1.13). Consider a nurse who is working with a patient who has just had a heart attack, providing education to them on making healthy dietary choices. An effective SMART goal for this patient may be "I will only eat out at a restaurant once a week." An ineffective SMART goal for this patient would be "I will only eat out at a restaurant once in a while." Nurses prioritize the outcomes based on the patient's needs, values, and preferences, as well as the urgency and significance of the identified concerns.

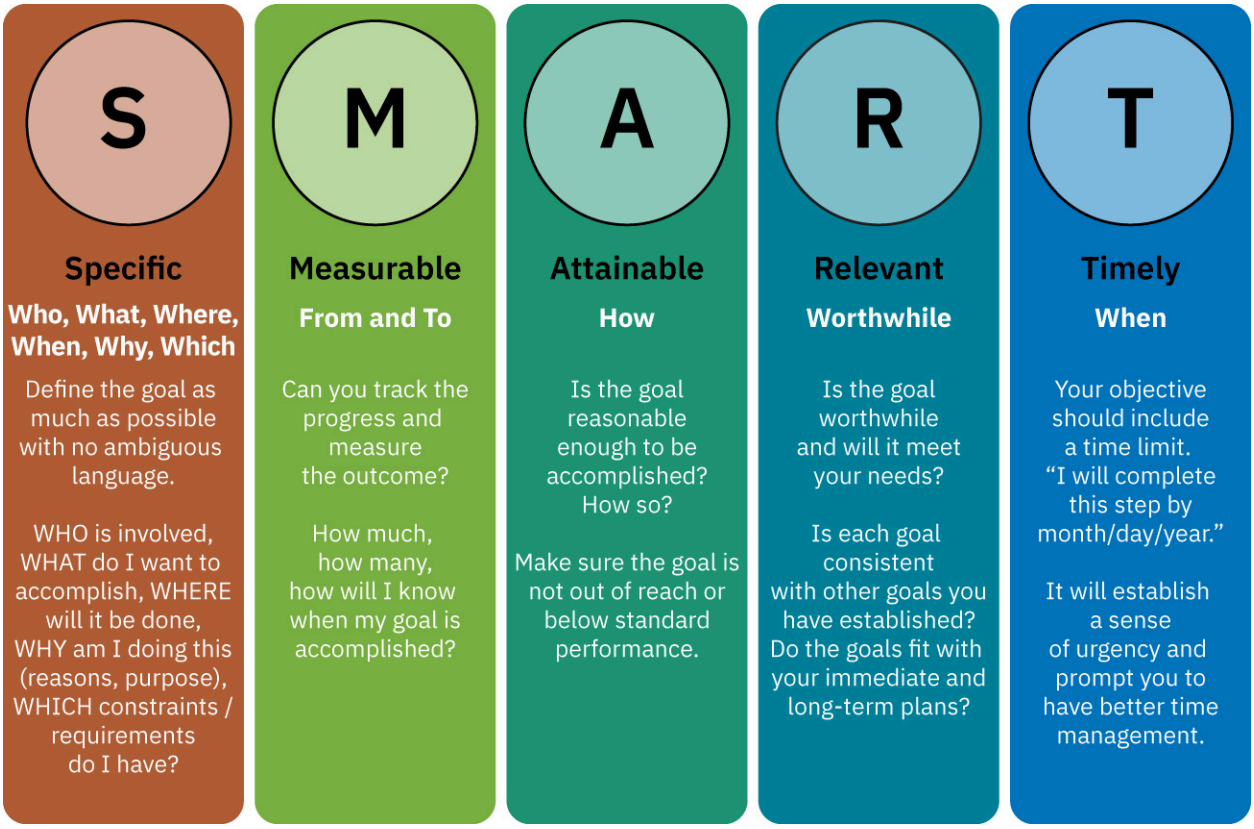

FIGURE 1.13 For best outcomes, patient goals should be SMART. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Develop Nursing Interventions

After establishing and planning for patient outcomes, nurses develop nursing interventions or actions that will help the patient achieve those outcomes. These interventions are evidence based and aligned with the nursing diagnosis, incorporating the best available research and clinical guidelines. Nursing interventions can be independent, dependent, or collaborative.

Any intervention that the nurse can independently provide without obtaining a prescription is considered an **independent nursing intervention**. An example of an independent nursing intervention is when the nurses monitor the patient's twenty-four-hour intake and output record for trends because of a risk for imbalanced fluid volume. Another example of independent nursing interventions is the therapeutic communication that a nurse uses to assist

patients to cope with a new medical diagnosis.

On the other hand, a **dependent nursing intervention** requires a prescription before it can be performed. Prescriptions are orders, interventions, remedies, or treatments ordered or directed by an authorized primary healthcare provider. For example, administering medication is a dependent nursing intervention. The nurse incorporates dependent interventions into the patient's overall care plan by associating each intervention with the appropriate nursing diagnosis.

A **collaborative nursing intervention** is an action that the nurse carries out in collaboration with other health team members, such as physicians, social workers, respiratory therapists, physical therapists, and occupational therapists. These actions are developed in consultation with other healthcare professionals and incorporate their professional viewpoint. An example of a collaborative nursing intervention is consulting with a respiratory therapist when the patient has deteriorating oxygen saturation levels.

Nurses consider the patient's unique circumstances, resources, and cultural background when formulating the interventions. The interventions may include a **direct care activity** such as administering medications, providing treatments, and assisting with activities of daily living. They may also involve an **indirect care activity** such as patient education, counseling, and coordination of healthcare services.

LIFE-STAGE CONTEXT

Outcome and Planning for Diverse Populations

When planning nursing interventions for a patient, it is important to consider the patient's individual circumstances. Two different patients with the same medical diagnosis may have vastly different ideas about what care they consider appropriate based on previous functionality, cultural background, age, and more.

For example, an otherwise healthy 42-year-old female who is diagnosed with a high-risk brain tumor may choose to aggressively pursue all avenues of treatment, including chemotherapy or surgery as needed. On the other hand, an 83-year-old male with a history of type 2 diabetes, kidney failure, coronary bypass surgery, and bilateral below the knee amputations may decide against any kind of aggressive treatment, choosing palliative care or hospice as their plan of care.

In these two examples, the ages and physical functionality of the patients help them to determine what plan of care is right for them. Even though they carry the same medical diagnosis, these two patients will have very different plans of care, including nursing diagnoses, outcomes, and interventions. For these reasons, the nurse must always consider the patient's unique circumstances and their wishes when developing the plan of care.

Creating a Nursing Care Plan

Nursing care plans are created by registered nurses. Documentation of individualized nursing care plans is legally required in long-term care facilities by the Centers for Medicare and Medicaid Services (CMS) and in hospitals by The Joint Commission (TJC). TJC is an independent, nonprofit organization that is one of the most prominent accrediting bodies for healthcare organizations and facilities in the country. It sets rigorous standards for patient care and safety, quality improvement, and the overall performance of healthcare organizations.

TJC conceptualizes the care planning process as the structuring framework for coordinating communication that will result in safe and effective care (The Joint Commission, n.d.). Many facilities have established standardized nursing care plans (Figure 1.14) with lists of possible interventions that can be customized for each specific patient. Other facilities require the nurse to develop each care plan independently. Whatever the format, nursing care plans should be individualized to meet the specific and unique needs of each patient.

Nursing Care Plan

PATIENT NAME: (First) _____ (Last) _____
ADDRESS: _____
DOB: _____ AGE: _____ GENDER: _____
CONTACT NUMBER: _____ EMAIL ADDRESS: _____
PROVIDER: _____ DIAGNOSIS: _____

CARE ALERT: ☐ Fall risk ☐ Confusion ☐ Deaf ☐ Blind

Nursing care goals	Medication admin.	Care required
Patient medications are managed correctly and safely	Baseline health assessment	*Level of assistance required:* ☐ Self-administers ☐ Nurse administers ☐ Extensive prompting ☐ Nurse observes ☐ Refer to medication chart for specific instructions
Notes:		

Nursing care goals	Pain management	Care required
Patient to be as pain-free as possible	Baseline health assessment	*Level of intervention required:* ☐ Analgesia ☐ Repositioning ☐ Massage ☐ Heat packs ☐ Aromatherapy ☐ Relaxation tapes ☐ Diversion ☐ One-to-one support ☐ Refer to chart for specific instructions for pain management
Notes:		

Nursing care goals	Communication	Care required
Patient's optimal levels of communication are maintained	Baseline health assessment	*Vision:* ☐ Glasses: always ☐ Glasses: for reading only ☐ Magnifier required ☐ Needs assistance with glasses ☐ Other
Nursing care goals	**Communication**	**Care required**
		Speech: ☐ Is English the first language? ☐ Yes ☐ No If no, specify language: _____ ☐ Difficulty with expressive communication ☐ Difficulty with receptive communication ☐ Nonverbal aids used: ☐ Yes ☐ No ☐ Requires assistance with communication aids: ☐ Yes ☐ No
Notes:		

Name	Date	Signature

FIGURE 1.14 A standardized care plan that is customizable may be used in some facilities. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Implementation

The **implementation** phase involves executing the planned nursing interventions according to the established plan of care (ANA, 2021). Nurses provide direct care, administer medications, deliver treatments, and educate patients and their families. They also coordinate with other healthcare professionals to ensure continuity and quality of care. Documentation of the interventions and patient responses is an essential part of this phase.

Perform Nursing Skills Identified in Planning

In this step, nurses perform the specific nursing skills or interventions identified in the planning phase. These interventions can include administering medications, providing wound care, assisting with mobility, conducting patient education, promoting self-care, and addressing psychosocial needs. Nurses implement the interventions with professionalism, empathy, and adherence to EBP.

Evaluation

The **evaluation** phase focuses on determining the effectiveness of the nursing interventions and the progress made toward achieving the established goals (ANA, 2021). Nurses assess the patient's response to interventions, reevaluate the data, and compare the outcomes with the expected results. If needed, modifications to the plan of care are made to promote better patient outcomes and address any new or evolving health needs.

Reassess to Determine if Outcomes Are Achieved

In this step, the nurse conducts a thorough reassessment of the patient to determine the extent to which the established outcomes have been achieved. They assess whether the patient's health has improved, stabilized, or deteriorated based on the identified criteria. They compare the patient's current status with the expected outcomes defined in the planning phase. This reassessment involves collecting new data, evaluating changes in the patient's condition, and reviewing any documentation or feedback from the patient. By evaluating the progress made toward achieving the outcomes, nurses can determine if the interventions have been effective in addressing the identified concerns.

Revise or Terminate Nursing Plan of Care

Based on the evaluation findings, nurses determine whether revisions to the nursing plan of care are necessary or if the plan can be terminated. If the outcomes have been achieved, the plan may be concluded, and the nurse focuses on discharge planning or transition to ongoing care. However, if the outcomes have not been met, the nurse revises the plan by identifying new interventions or modifying existing ones to better support the patient's progress toward achieving the desired outcomes. Nurses continue to reassess and evaluate the patient's condition at regular intervals, making adjustments to the plan of care as needed to optimize outcomes and address any emerging concerns.

LINK TO LEARNING

This tribute to the diverse nursing and patient populations in the United States (https://openstax.org/r/77NursesTribute) was a TED talk given by Carolyn Jones. It is an illustration of the complex, diverse world of nursing and why individualized, patient-centered care is so important to the nursing process.

Summary

1.1 Principles of Nursing Practice

According to the ANA, nursing integrates the art and science of caring and focuses on the protection, promotion, and optimization of health and human functioning; prevention of illness and injury; facilitation of healing; and alleviation of suffering through compassionate presence. In recent decades, the goals of nursing have further evolved to emphasize evidence-based practice, patient-centered care, and interdisciplinary collaboration. Nurses play critical roles in care coordination, healthcare leadership, and policy development. They actively engage in health promotion, disease management, and support for individuals and communities. Nurses are the coordinators of care for patients and communities, and nursing goals continue to change and develop as society progresses.

The ANA's ethical principles serve as a crucial foundation for nursing practice, guiding nurses in ethical decision-making and ensuring the provision of high-quality, patient-centered care. These seven principles provide a framework that upholds the values and ethical standards of the nursing profession.

The purpose of nursing clinical judgment measurement model (CJMM)s is to provide a structured framework that guides nurses in developing and applying their clinical judgment skills. These models aim to enhance nurses' critical thinking abilities, improve their decision-making processes, and promote consistent and evidence-based nursing practice. Clinical judgment models provide nurses with a systematic approach to collecting and analyzing patient data, identifying patterns and trends, and making informed clinical decisions.

1.2 Evidence-Based Practice

Interdisciplinary theories are an essential part of nursing as they provide a broader perspective and a more comprehensive understanding of healthcare issues. These theories integrate knowledge and concepts from multiple disciplines to enhance nursing practice, research, and education. In nursing, interdisciplinary theory are used in various ways. They assist in the development of nursing models and frameworks that guide the delivery of patient care, and help nurses understand and work better with the interdisciplinary team.

Nursing research has undergone significant evolution over time, transitioning from a tradition-based practice to a scientifically rigorous discipline. Initially, nursing relied on personal experience and tradition, but beginning in the nineteenth century, the need for EBP became evident. EBP refers to the integration of the best available research findings, clinical expertise, and patient preferences or values to guide healthcare decision-making and improve patient outcomes.

According to the ANA, there are five key steps in implementing EBP: Ask a clinical question, acquire the evidence, appraise the evidence, apply the evidence, and assess outcomes.

1.3 Nursing Process

Nurses use the nursing process to perform clinical reasoning, make clinical judgments, and create nursing care plans to provide patient care. The process includes assessment, which can be focused or comprehensive, to gather patient data, followed by data validation, organization, and documentation. Diagnosis involves analyzing the data to identify health problems. This leads to the identification of potential and actual patient concerns. In the planning phase, nurses collaborate with patients to establish specific, measurable, attainable, relevant, and timely (SMART) outcomes. Nursing interventions are developed, considering the patient's unique circumstances. Implementation entails executing the planned interventions, while the evaluation phase assesses their effectiveness. Reassessment is conducted to determine if outcomes have been achieved, and the plan of care is revised accordingly. This process ensures quality patient care while respecting individual needs and preferences.

Key Terms

accountability taking responsibility for one's own actions and accepting all consequences, both personal and professional, that can result from these actions

adaptive coping a coping strategy that includes problem-focused coping and/or emotion-focused coping

assessment a nursing process phase that involves gathering comprehensive data about the patient's health status, including physical, psychological, social, and cultural aspects

at-risk population a group of individuals who are at higher risk of experiencing adverse health, social, or economic

outcomes due to various factors

autonomy respecting the right of patients to make their own decisions and participate in their care

beneficence acting in the best interest of patients and promoting their well-being

collaborative nursing intervention an action that the nurse carries out in collaboration with other health team members, such as physicians, social workers, respiratory therapists, physical therapists, and occupational therapists

comprehensive assessment an assessment that provides a more extensive and detailed overview of a patient's overall health; it encompasses physical, psychological, and social aspects of a patient's well-being

confidentiality the ethical and legal duty to safeguard and protect sensitive and private information from unauthorized disclosure or access, ensuring it remains secure from others

coping strategy an action, a series of actions, or a thought process used in meeting a stressful or unpleasant situation or in modifying one's reaction to such a situation

dependent nursing intervention an action that requires a prescription before it can be performed

descriptive theory (also phenomenological theory) a type of theory that focuses on describing and understanding the lived experiences of individuals in the context of health care

developmental theory framework that aims to explain and understand how individuals grow, change, and develop across various stages of life, emphasizing the interaction between biological, cognitive, social, and emotional factors in shaping human development

diagnosis a nursing process phase in which nurses analyze and interpret the collected data to identify nursing diagnoses or health problems

direct care activity an action such as administering medications, providing treatments, and assisting with activities of daily living

element one of the parts, such as an object, person, process, or concept, that make up a system

emotion-focused coping strategies such as mindfulness, meditation, and yoga; using humor and jokes; seeking spiritual or religious pursuits; engaging in physical activity or breathing exercises; and seeking social support

Erikson's psychosocial development theory an outline of the eight stages of human development, each characterized by a unique psychosocial crisis or challenge

ethical guidelines and standards research documents that provide ethical frameworks and principles that guide researchers in conducting ethical and responsible research

evaluation a nursing process phase that focuses on determining the effectiveness of the nursing interventions and the progress made toward achieving the established goals

evidence-based practice (EBP) the integration of the best available research evidence, clinical expertise, and patient preferences or values to guide healthcare decision-making and improve patient outcomes

external stimulus the physical, social, and cultural aspects of the environment

fidelity demonstrating faithfulness, loyalty, and commitment to patients

focused assessment a targeted assessment designed to address a specific concern

framework of nursing theory a structured and organized approach to understanding and applying nursing concepts and principles

general systems theory a conceptual framework that describes how systems function and interact with their environment

health promotion empowering individuals, families, and communities to take control of their well-being and make positive choices

holistic nursing care nursing care that emphasizes the healing of the whole person, including mind, body, and soul

implementation a nursing process phase that involves executing the planned nursing interventions according to the established plan of care

independent nursing intervention any intervention that the nurse can independently provide without obtaining a prescription

indirect care activity an action such as patient education, counseling, and coordination of healthcare services

informed consent a voluntary and well-informed agreement given by a patient after receiving comprehensive information about the risks, benefits, alternatives, and potential consequences of a medical intervention or treatment

interdisciplinary theory a theory that integrates knowledge and concepts from one or more disciplines to enhance nursing practice, research, and education

internal stimulus physiological, psychological, and cognitive factors
justice a principle and moral obligation to act on the basis of equality and equity
Leininger's theory of culture care diversity and universality a theory that focuses on describing the impact of cultural beliefs, values, and practices on health and nursing care
maladaptive coping a coping strategy that includes the avoidance of a stressful condition, withdrawal from a stressful environment, disengagement from stressful relationships, or misuse of drugs and/or alcohol
Maslow's hierarchy of needs theory a theory that states that individuals have a hierarchical structure of needs, ranging from basic physiological needs to self-actualization
nonmaleficence avoiding harm and preventing or minimizing potential risks to patients
nursing diagnosis clinical judgment based on the medical diagnosis of a patient that helps the nurse determine the plan of care
nursing metaparadigm the four foundational concepts that are central to the discipline of nursing: person, environment, health, and nursing
nursing process a critical thinking model based on a systematic approach to patient-centered care.
nursing theory a set of organized concepts, principles, and relationships that guide and inform nursing practice
planning phase a nursing process phase when nurses collaborate with the patient, their family, and the interdisciplinary healthcare team to set achievable goals or outcomes and develop a comprehensive plan of care
prescriptive theory a type of theory that provides guidance and direction for nursing practice by offering recommendations, interventions, or guidelines to achieve desired outcomes
problem-focused coping a strategy that includes seeking treatment such as counseling or cognitive behavioral therapy
qualitative research a systematic and subjective approach that focuses on understanding and interpreting human experiences, meanings, and social phenomena in the context of health care
quantitative research a systematic and empirical approach that involves the collection, analysis, and interpretation of numerical data to answer research questions and explore phenomena related to health care
Roy's adaptation model a conceptual framework developed by nursing theorist Sister Callista Roy that is based on the belief that individuals strive to maintain balance and achieve a state of equilibrium in response to changes in their internal and external environments, and aims to promote adaptation for optimal health and well-being
system a set of elements that are interrelated and work together to achieve a common goal
veracity honesty and truthfulness in communication
Watson's theory of human caring a theory that emphasizes the significance of caring in nursing practice

Assessments

Review Questions

1. Florence Nightingale is considered the founder of _____, which emphasizes the healing of the whole person, including mind, body, and soul.
   a. caring nursing
   b. the seven ethical principles of nursing
   c. holistic nursing
   d. systems nursing

2. What ethical principle is defined as "acting in the best interest of patients and promoting their well-being"?
   a. fidelity
   b. beneficence
   c. justice
   d. nonmaleficence

3. The nurse's ability to develop and implement appropriate actions or interventions based on the interpretation of the collected data and identified patient needs is the _____ step of the clinical judgment model.
   a. noticing
   b. interpreting
   c. responding

d. reflecting

4. When a nurse takes a role centered around empowering individuals, families, and communities to take control of their well-being and make positive choices, this is known as _____.
   a. care planning
   b. health promotion
   c. role modeling
   d. community nursing

5. What is the purpose of integrating interdisciplinary theories with nursing theory and practice?
   a. to break down current nursing theories and dictate the formation of future nursing theory
   b. to assist in the development of nursing models and frameworks that guide the delivery of patient care, and help nurses understand and work better with the interdisciplinary team
   c. to discourage overreliance on nursing theory alone
   d. to encourage other disciplines to learn about nursing theory and integrate it into their practice

6. What is the importance of the evolution of nursing to include evidence-based practice (EBP)?
   a. The emergence of EBP has contributed to the scientific quality of nursing practice. It integrates research findings into nursing practice, ensuring that decisions are based on the best available evidence.
   b. EBP provides a scientific foundation for informed nursing practice and discourages the use of other, nonscientific issues such as cultural differences and patient preference in nursing practice.
   c. EBP ensures that nursing practice remains based in tradition and is not adaptable to changes in current scientific recommendations.
   d. EBP provides suggestions to nurses on improving patient care, but the nurse is still able to reject EBP in clinical practice if they disagree with it.

7. In the hierarchy of EBP, what are the strongest sources of evidence at the top of the hierarchy?
   a. randomized controlled trials (RCTs)
   b. one-on-one patient interviews
   c. case studies
   d. systematic reviews and meta-analyses

8. What type of nursing theories focus on describing and understanding the lived experiences of individuals in the context of health care?
   a. descriptive
   b. hierarchical
   c. prescriptive
   d. systems

9. Identifying potential patient concerns is a step in what part of the nursing process?
   a. assessment
   b. diagnosis
   c. implementation
   d. evaluation

10. What phase focuses on determining the effectiveness of the nursing interventions and the progress made toward achieving the established goals?
   a. assessment
   b. planning
   c. intervention
   d. evaluation

11. What is patient education an example of?
   a. direct care activity
   b. collaborative intervention
   c. indirect care activity
   d. systematic approach

12. What is the primary responsibility of The Joint Commission (TJC)?
   a. to enforce federal health regulations
   b. to provide accreditation for healthcare facilities and organizations based on guidelines and standards for best practices
   c. to ensure that patients receive the best care possible
   d. to provide licensing and certifications to healthcare professionals

Check Your Understanding Questions

1. Discuss the definition and importance of the ethical principle of fidelity.

2. Briefly discuss how and why the goals of nursing have evolved and changed over time.

3. Discuss the importance of integrating interdisciplinary theories with nursing theories and practice.

4. Define quantitative and qualitative data and discuss the main differences between the two.

5. Define the nursing process and briefly discuss its purpose.

6. Why is the evaluation phase crucial in nursing care planning?

Reflection Questions

1. Why is the reflection step in the clinical judgment model so crucial for professional development and growth in nursing?

2. Why is holistic care a central concept in nursing?

3. How does the hierarchy of evidence-based practice help nurses in determining the quality of EBP?

4. Why have Erik Erikson's psychosocial development theory and Abraham Maslow's hierarchy of needs theory had such heavy influence on nursing theory?

5. How does the nurse decide which nursing interventions to implement?

6. How does The Joint Commission's accreditation and standards influence the development and implementation of individualized nursing care plans?

Competency-Based Assessments

1. Research the history of holistic nursing and prepare a ten-minute slideshow presentation on its development in nursing practice.

2. Health promotion is a fundamental role of nursing. In a few sentences, discuss what health promotion as a nurse means to you. As a nurse, how do you plan to practice health promotion with your patients? Give specific examples.

3. In Section 1.1, you learned about the history of holistic nursing. Find at least two examples of evidence-based research about holistic nursing. Identify the types of research and their places on Melnyk and Fineout-Overholt's levels of evidence. The research should be current (within the past five years). Present your research to your group or class. Include discussion of the levels of evidence of your research. What do you conclude about the strength of recommendation for holistic nursing?

4. In the planning phase, nurses collaborate with patients to establish specific, measurable, attainable, relevant, and timely (SMART) outcomes. Create five SMART goals for yourself centered around the concept of holistic nursing.

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CHAPTER 2
The Evolution of the Nurse's Role

FIGURE 2.1 This large group of Black Cross Nurses are parading through Harlem in 1922 in support of the Universal Negro Improvement Association in an example of nursing professional development and self-advocacy. (credit: "Unia-nurses 1922corbis.jpg" by Universal African Black Cross Nurses/Wikimedia Commons, Public Domain)

CHAPTER OUTLINE

2.1 Changing with Trends
2.2 Patient-Centered Care
2.3 Practice Standards
2.4 Collaborative Care

INTRODUCTION The evolution of the nurse's role is a fascinating story that reflects the dynamic nature of the evolution of health defined, health care, and the ever-expanding responsibilities of nurses. From its humble beginnings as a female-only discipline, nursing has evolved into a distinct and autonomous profession with a vital role in patient care.

Historically, nurses were often viewed as assistants to physicians, following their directives without much autonomy. However, influential figures like Florence Nightingale challenged this perception and advocated for the professionalization of nursing. Throughout the 20th century, the nurse's role continued to evolve in response to societal changes and advancements in health care and technology. Nurses transitioned from primarily providing bedside care to assuming more complex responsibilities within many settings. In the contemporary era, nurses have emerged as essential healthcare providers and partners in interdisciplinary teams.

The evolution of the nurse's role is a testament to the dedication, knowledge, and adaptability of nursing professionals. As nursing students, you have the privilege of joining this dynamic profession at an exciting time. You will have many opportunities to advance nursing practice, advocate for patients, and contribute to the ever-evolving landscape of health care. Remember, you are becoming part of a profession with a rich history and a promising

future, where your expertise and compassion will shape the delivery of patient care and positively impact lives.

2.1 Changing with Trends

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the progression of nursing into a professional discipline
- Identify current trends in nursing
- Recognize future trends for nursing professionals

Understanding the history of nursing is crucial for nurses as it provides a foundation for the professional identity and instills a sense of pride and appreciation for the evolution of the profession. By knowing the challenges and achievements of nursing pioneers, nurses can develop a deeper understanding of the values and principles that lie at the foundation of nursing practice. Additionally, understanding the history of nursing allows nurses to better understand current practices, critically evaluate their effectiveness, and actively participate in shaping the future of the profession. The knowledge serves as a source of inspiration, empowering nurses to innovate, advocate, and contribute to the ongoing development and advancement of nursing care.

History of Nursing

The history of nursing is a tapestry woven through time, reflecting the evolving roles and responsibilities of caregivers. It finds its earliest roots in ancient civilizations, where individuals primarily cared for the sick within their communities. Yet, it was Florence Nightingale in the 19th century who sparked a transformative shift. During the Crimean War, she pioneered modern nursing practices, emphasizing hygiene, systematic recordkeeping, and compassion. This laid the foundation for nursing as a respected profession.

As the 20th century unfolded, nursing continued to evolve. Nursing education programs became more structured, and nurses gained recognition for their vital role in health care. Today, nursing encompasses a diverse array of specialties, from critical care to research, and nurses are at the forefront of healthcare delivery, making an indelible mark on the well-being of individuals and communities worldwide.

Beginning of Professional Nursing

The development of modern, professional nursing can be traced back to the efforts of Florence Nightingale and the impact of the Crimean War in the mid-19th century. Nightingale, an Englishwoman who is often referred to as the founder of modern nursing, revolutionized the profession by emphasizing the importance of proper sanitation, hygiene, and evidence-based practice (Matthews et al., 2020).

During the Crimean War (1853–1856), Nightingale and a team of nurses were deployed to the British military hospital in Scutari, Turkey (Matthews et al., 2020). There, Nightingale found extremely poor conditions among the wounded, with rampant infection, poor hygiene, inadequate nutrition, and lack of proper medication. She implemented significant changes in patient care, including improved sanitation and infection control measures in the form of handwashing, frequent cleaning of the wards, and improved ventilation. Additionally, Nightingale gathered important statistical data linking improved hygiene practices to lower disease and mortality rates (Figure 2.2). She used this data to petition the British government for improved sanitary conditions across the British Empire.

Following the war, Nightingale's efforts gained recognition, and her ideas spread throughout Europe and the United States. The Nightingale Training School for Nurses was established in London in 1860, marking the beginning of formal nursing education. Nightingale's emphasis on education, professionalism, data collection, and high standards of care laid the foundation for the development of nursing as a respected and skilled profession.

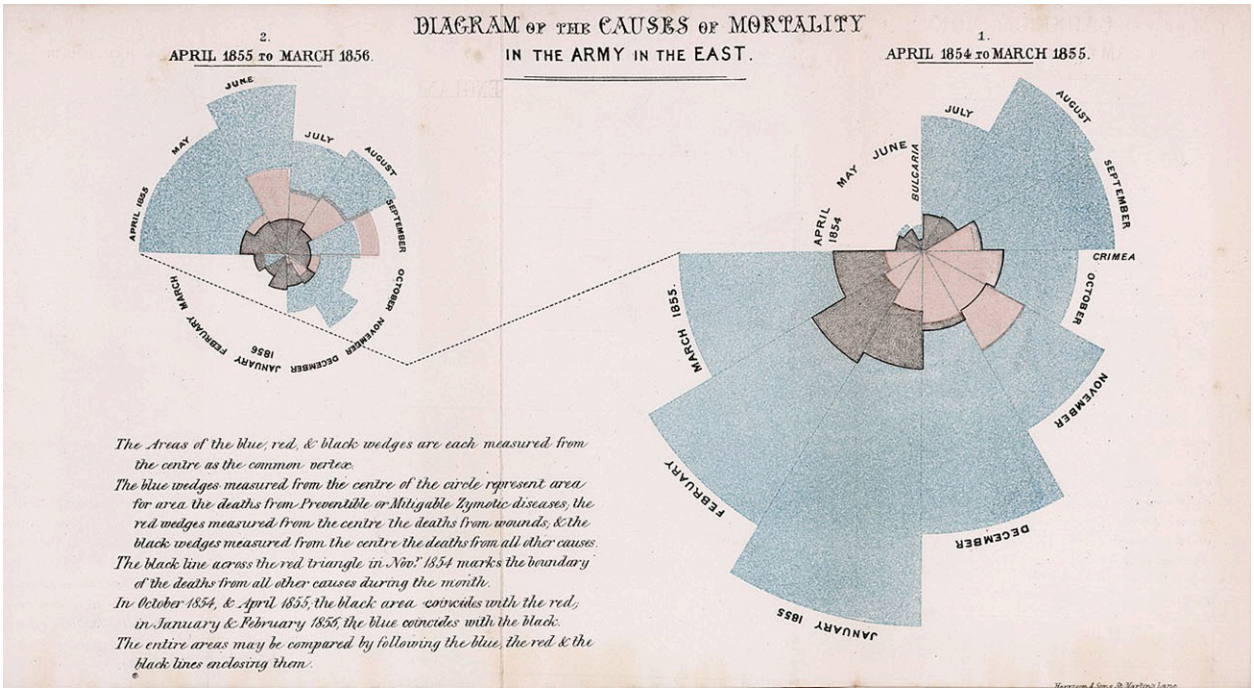

FIGURE 2.2 One of the ways in which Florence Nightingale pioneered the use of evidence-based practice in nursing was capturing data on the causes of death in the British Army and documenting them on her "rose diagram" chart. This chart represents data collected related to the cause of death of British soldiers. (credit: "Nightingale-mortality.jpg" by Florence Nightingale/Wikimedia Commons, Public Domain)

Nursing into the 20th Century

Significant advancements and transformations in the field of nursing were seen in the 20th century. During this period, nursing witnessed a remarkable evolution in education, practice, specialization, and professional recognition. One of the most important advancements has been the shift toward formalized nursing education and the emphasis on evidence-based practice (EBP). Nursing education shifted from being hospital based to having established schools and programs within colleges and universities, offering a more structured and comprehensive curriculum. This new focus began the introduction of licensure and regulation. States and countries began to implement licensure and regulation for nurses to ensure a minimum level of competency and to protect the public. This led to the establishment of nursing boards and regulatory bodies. Scientific knowledge and clinical skills became integral parts of nursing education; evidence-based practice became a fundamental principle. Nurses were trained to critically evaluate research evidence, integrate it with clinical expertise and patient preferences, and apply it to guide their nursing practice. Nurses also began conducting research to improve patient care, develop evidence-based practices, and contribute to the broader healthcare knowledge base.

Theoretical Foundations of Nursing

Alongside the formalization of nursing education, the development of theoretical foundations in nursing has evolved in response to changing healthcare landscapes and the expanding role of nurses (Current Nursing, 2020). Early nursing theories, like Florence Nightingale's Environmental Theory in the 19th century, emphasized the nurse's pivotal role in creating a healing environment. In the mid-20th century, theorists such as Sister Callista Roy and Hildegard Peplau introduced groundbreaking concepts focusing on patient needs and the nurse-patient relationship. More contemporary nursing theorists like Jean Watson and Patricia Benner have contributed valuable insights into human caring and the journey from novice to expert in nursing practice. Madeleine Leininger's Transcultural Nursing Theory has strongly informed and shaped recent developments in culturally competent nursing care. Nurses also use non-nursing theories to inform nursing care. For example, nurses use Abraham Maslow's Hierarchy of Needs to assess and prioritize patient needs, understanding that physiological needs like food and safety must be met before addressing higher-level needs like belongingness and self-actualization.

Professional Nursing Organizations

In addition to formalizing nursing education, nursing organizations and associations were established in an effort to unify nurses and promote professional standards. The American Nurses Association (ANA), now the largest organization of registered nurses in the United States, was founded in 1896 as the Nurses' Associated Alumnae of

the United States and Canada (ANA, 2017). (The ANA adopted its current name in 1911.) Its primary objective was to establish a professional organization for nurses and promote high standards of nursing education and practice.

The ANA has focused on advocating for improvements in education, licensure, and working conditions for nurses. It has played a crucial role in the development of standardized nursing curricula and the establishment of state licensing laws for nurses. The ANA initiated the publication of professional journals and nursing literature to promote the exchange of knowledge and best practices. It has continued to advocate for important policy changes such as advocating for the right for nurse practitioners to practice more autonomously and for the right of both documented and undocumented immigrants to purchase health insurance and receive adequate health care (ANA, n.d.). The ANA is one of the most important and influential nursing organizations in the United States as it exists to enhance the nursing profession's recognition and influence and ensure the delivery of safe, quality care to patients.

Technological Developments

The integration of technology into health care throughout the 20th century is another development that has markedly impacted nursing practice. Technological advancements such as portable and remote monitoring, diagnostic testing and tools, improved evidence-based treatments, and electronic health record (EHR) have vastly changed how nursing care is delivered and improved its efficacy. Tools such as smart pumps, extracorporeal life support (a type of heart bypass machine), and noninvasive mechanical ventilation (ventilation provided without the need for endotracheal intubation) do not just make nursing care more efficient, they improve patient outcomes (Popowicz & Leonard, 2022). The ongoing impact of constantly evolving technologies on nursing is further discussed in 4.3 Informatics.

Specialization of Nursing Roles

Advancements in technology and medical science have spurred the development of specialized areas of nursing. The trend toward specialization has allowed nurses to develop expertise in specific patient populations and healthcare settings. For example, some nurses work specifically with children (pediatrics), while others work solely with patients diagnosed with cancer (oncology), while others specialize in critical care. Specialization also includes expanding nursing practice beyond the traditional roles of bedside care to include broader responsibilities. Today many nurses serve in advanced practice roles, such as nurse practitioners, clinical nurse specialists, nurse anesthetists, and nurse-midwives. They may also work in academia, as administrators, in research, or in corporate settings. These roles require additional education and training.

Current Trends in Nursing

Current nursing trends reflect the dynamic nature of health care. Educationally, there is a growing emphasis on lifelong learning and advanced degrees, as well as an increased focus on diversity, equity, and inclusion. Legislative trends highlight the expansion of nurse practitioners' roles, granting them greater autonomy to address primary care shortages. Additionally, telehealth and digital health technologies have become integral, enabling nurses to provide remote care. Staffing trends focus on addressing the nurse shortage through strategies like nurse residency programs, efforts to improve nurse-to-patient ratios, as well as flexible staffing patterns to meet the individual needs and preferences of the staff and unit. In the face of these trends, nursing remains at the forefront of health care, adapting to new technologies and evolving roles while delivering quality patient-centered care.

Educational Trends

In 2021, the American Association of Colleges of Nursing (AACN) updated its framework for nursing education in the 21st century. In this updated framework, the AACN identified modern issues that should be included in current nursing education in order to best prepare students for future nursing practice.

According to the AACN, modern nursing education should align with current trends and values, encompassing crucial elements such as promoting diversity, equity, and inclusion within the profession; nurturing proficiency in systems-based practice; fostering competence in healthcare informatics and technology; fostering academic-practice partnerships; and instilling a commitment to continuous and advanced learning throughout one's nursing career. It should be competency based, an approach that focuses on assessing and developing specific skills, knowledge, and abilities in students, ensuring they are proficient in the essential competencies required for nursing practice rather than just completing a predetermined amount of time in a program.

One of the most important issues in current educational trends is **diversity, equity, and inclusion (DEI)** (Jolley &

Peck, 2022). DEI represents the commitment to recognizing and embracing differences, ensuring fairness, and fostering a sense of belonging for all individuals in order to create a more equitable and enriched nursing profession and healthcare system. Incorporating DEI into nursing education is essential for producing culturally competent, compassionate, and equitable nurses. It enhances nursing education by exposing students to various perspectives and experiences, enabling nurses to provide holistic and patient-centered care that respects and meets the unique needs of diverse populations. Additionally, by fostering DEI in nursing education, programs can attract students from underrepresented backgrounds and create a more diverse nursing workforce, representative of the populations in which we serve. This diversity helps improve access to care, patient satisfaction, and patient outcomes, as individuals tend to feel more comfortable and understood when cared for by healthcare professionals who share their cultural or linguistic background.

Another important purpose of emphasizing DEI is to address health disparity. Healthcare disparities exist among populations due to various factors called **social determinant of health (SDOH)**, which include socioeconomic status, race, ethnicity, physical and social environment, as well as gender. Health disparities can also be attributed to systemic inequalities and biases. Nursing education can equip students with the knowledge and skills to identify and challenge these disparities. By examining the impact of SDOH, discriminatory practices, and healthcare biases, nursing students can become advocates for change, striving to eliminate health disparities and promote social justice (see 5.1 Understanding Cultural Differences).

Furthermore, nursing schools are increasingly recognizing the importance of collaborative practice and incorporating **interprofessional education (IPE)** into the curriculum. Students from a variety of healthcare disciplines, such as nursing, medicine, pharmacy, and social work, learn together to develop effective teamwork, communication, and shared decision-making skills. IPE prepares nurses to work collaboratively in interprofessional healthcare teams to optimize patient outcomes.

Nursing education also recognizes the need for nurses to assume leadership and management roles in healthcare settings. There is an increasing emphasis on developing leadership competencies, such as effective communication, problem-solving, decision-making, and team management skills. Leadership education equips nurses to advocate for patients, drive quality improvement initiatives, and navigate the complexities of the healthcare system.

Finally, nursing education and training must continually evolve to incorporate the rapid advancement of healthcare technologies and informatics systems. Students today learn to utilize EHRs, telehealth platforms, simulation technologies, and other digital tools to enhance patient care, communication, and data management.

Legislative Trends

Current legislative trends in nursing include ongoing efforts to improve healthcare delivery, enhance patient and nurse safety, expand the scope of nursing practice, and address the nationwide nursing shortage.

Many states are expanding the scope of practice for **advanced practice registered nurses (APRNs)**, including nurse practitioners, certified nurse-midwives, clinical nurse specialists, and certified registered nurse anesthetists. Legislative changes are granting APRNs greater autonomy in diagnosing and treating patients, prescribing medications, and practicing independently (ANA, 2022). This is particularly helpful in areas with provider shortages, where APRNs can help fill primary care provider needs and other crucial roles.

Another means to address provider shortages is **telehealth**, which gained significant importance during the COVID-19 pandemic. Legislation is being enacted to support and regulate the use of telehealth services, ensuring that nurses can provide remote care to patients across state lines. These legislative efforts aim to increase access to health care, particularly for underserved populations in rural and remote areas. Legislation is also being introduced to address the nursing shortage and promote workforce development. Related initiatives include increased funding for nursing education programs, scholarships, and loan forgiveness programs to incentivize nursing careers, and the establishment of nursing residency programs to support the transition of new graduates into practice.

The **Nursing Licensure Compact (NLC)** is an initiative for allowing nurses to practice across state lines without obtaining additional licenses and is one way to address nursing shortages in underserved areas. The NLC has gained momentum, with many states enacting legislation to join the compact. This legislative trend facilitates the mobility of nurses and supports the provision of care in regions with workforce shortages or during emergencies.

Finally, legislation is being introduced to address workplace violence against healthcare professionals, including

nurses (Table 2.1). These laws aim to establish protections, prevention strategies, and reporting mechanisms to ensure a safe work environment for nurses and other healthcare providers.

Current Legislative Trend	Examples of Proposed or Enacted Legislation	How Will This Law Help?
Enhanced autonomy for advanced practice registered nurses (APRNs)	**R. 8812, the Improving Care and Access to Nurses (I CAN) Act.** This proposed legislation aims to eliminate care obstacles permanently and enhance the availability of services offered by APRNs within the Medicare and Medicaid programs.	It improves the type and availability of services that APRNs are able to provide within the Medicaid and Medicare programs.
Telehealth expansion	**Advancing Telehealth Beyond COVID-19 Act of 2022.** Extends certain expanded Medicare benefits for telehealth services enacted during COVID-19 to December 31, 2024.	Allows for the continued provision of certain telehealth services for patients who use Medicare until late 2024.
Nursing shortages	**R. 851/S. 246, the Future Advancement of Academic Nursing (FAAN) Act.** This proposed legislation would provide funding to increase the number of nursing faculty and improve nursing educational programs.	The funding provided would increase the number of nursing faculty and availability of places for students in nursing schools, ultimately increasing the number of new graduate nurses available for employment.
Violence against nurses	**R. 1195/S. 4182, the Workplace Violence Prevention for Health Care and Social Service Workers Act.** This law would enact strict standards for healthcare employers and hold them accountable for acts of workplace violence against their employees.	This law will ensure protections for nurses in the workplace against workplace violence from patients, families, coworkers, and others.

TABLE 2.1 Legislation Related to Current Nursing Trends (Source: ANA, 2022.)

Staffing Trends

One of the most urgent and important trends in nursing staffing is the nursing shortage. The persistent nursing shortage has been significantly exacerbated by the impact of the COVID-19 pandemic. Prior to the pandemic, there was already a shortage of nurses, driven by factors such as an aging workforce with an increasing number of retiring nurses, increased healthcare demand due to an aging population, and an insufficient pipeline of new nurses due to a shortage of nursing school openings and faculty availability. However, COVID-19 introduced new challenges. The pandemic placed an unprecedented burden on healthcare systems, creating an urgent need for nurses to care for a surge in patients. At the same time, many nurses experienced heightened levels of burnout, physical and emotional fatigue, and increased risk of illness, leading some to take early retirements or leave the profession. Furthermore, nursing education programs struggled to adapt to remote learning and provide clinical experiences safely, limiting the number of new graduates entering the workforce. As a result, the existing nursing shortage has deepened, necessitating urgent attention and strategic solutions to ensure adequate nursing staff to meet the healthcare needs of communities, both during the pandemic and in its aftermath.

Retaining and attracting new and experienced nurses has become a priority for healthcare organizations. Strategies such as improved work environments, competitive compensation packages, professional development opportunities, flexible scheduling options, and recognition programs are being implemented to enhance nurse job satisfaction and reduce turnover. Many organizations are partnering with nursing schools for academic and clinical

partnerships in an effort to recruit new graduate nurses. Organizations are also focusing on fostering a positive and supportive culture that promotes nurse well-being and engagement.

Many healthcare organizations and policymakers are recognizing the importance of appropriate nurse staffing ratios to ensure patient safety and quality of care. Efforts are being made to establish and enforce optimal nurse-to-patient ratios, particularly in acute care settings. These ratios aim to balance workload and provide nurses with manageable patient assignments, reducing stress for nurses, ensuring safe and high-quality care, and improving outcomes for patients. The use of acuity tools to accurately capture patient needs and match them with appropriate nurse coverage is one way organizations are seeking to optimize nurse staffing.

Technological advancements are also impacting nursing staffing trends. The integration of EHRs, telehealth platforms, and healthcare informatics systems into practice can streamline documentation, communication, and care coordination, reducing administrative burdens and optimizing nurse workflow. Automation and robotics are also being explored to assist with routine tasks, allowing nurses to focus more on direct patient care.

Future Trends for the Nursing Profession

The future of the nursing profession holds many exciting opportunities as well as challenges that must be addressed as the profession continues to evolve. There is an increasing recognition of the importance of nursing self-care to combat burnout and ensure long-term career sustainability. Nurses are becoming advocates not only for themselves but also for systemic changes in healthcare policy and equity. Additionally, the rapid expansion of telehealth and digital healthcare delivery, catalyzed by the COVID-19 pandemic, is expected to continue, requiring nurses to adapt to new modes of care and communication. These trends collectively reflect a nursing profession that is dynamic, responsive to emerging technologies, and driven by a commitment to holistic care, social justice, and the well-being of both patients and healthcare providers.

Nursing Self-Care

The growing importance of nursing self-care stems from the recognition that nurses are susceptible to physical, emotional, and mental exhaustion due to the demanding nature of their profession. Nurses often work long hours, face high levels of stress, and prioritize the well-being of others over their own needs. As a result, they are at risk for developing **burnout**, compassion fatigue, and moral distress (Wolotira, 2023). Burnout is characterized by emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment. On the other hand, **compassion fatigue** is the emotional and physical exhaustion that results from providing empathetic care to those experiencing trauma or suffering. Then **moral distress** is the emotional and psychological distress experienced when nurses are aware of the ethically right course of action but are constrained from pursuing it due to external factors or institutional limitations. Burnout, compassion fatigue, and moral distress can lead to symptoms such as difficulty concentrating, exhaustion, trouble sleeping, isolation, anxiety, decreased empathy, and absenteeism. Left untreated, these issues can lead to even more serious issues such as depression, post-traumatic stress disorder, and suicidal thoughts or behaviors.

Self-care practices—such as adequate rest, exercise, healthy eating, and stress management—contribute to improved physical and mental well-being. Engaging in self-care activities helps nurses recharge, reduce stress levels, build resilience, and prevent the detrimental effects of burnout and compassion fatigue. By prioritizing their own well-being, nurses can better cope with the demands of their profession and maintain a positive mindset. Nurses who are physically and emotionally well can offer compassionate and attentive care, make sound clinical decisions, and effectively communicate with patients and their families. Consequently, self-care for nurses contributes to better outcomes for patients, including improved satisfaction, adherence to treatment plans, and overall well-being. Encouraging self-care practices and providing resources can also lead to decreased absenteeism, improved job satisfaction, and higher retention rates among nurses.

To address the growing importance of nursing self-care, nurses and the people who train them can implement various strategies. These include promoting self-care awareness and education, encouraging self-care practices in nursing education programs and continuing professional development, providing resources and support systems for nurses, fostering a culture of work-life balance, and implementing policies that prioritize employee well-being.

LINK TO LEARNING

The American Psychiatric Nurses Association offers a self-care tip sheet (https://openstax.org/r/77SelfCareTips) with suggestions for nurses to help sustain their mind, body, and spirit and prevent burnout.

Nursing's Role in Telehealth and Technology

Nursing's role in telehealth and technology is expanding rapidly, transforming the way health care is delivered and accessed. Telehealth is a method of using telecommunications technology to provide healthcare services remotely. Nurses are increasingly at the forefront of utilizing telehealth and embracing technology to provide care, enhance patient outcomes, and improve healthcare efficiency. Table 2.2 identifies some key aspects of nursing's growing role in telehealth and technology.

Nursing Role	What It Is	Why It Is Important
Remote patient monitoring	Patients' vital signs, symptoms, and health data are collected remotely through wearable devices or home monitoring systems.	Nurses analyze and interpret the data, identify potential issues, and provide timely interventions. This allows for proactive management of chronic conditions, early detection of complications, and reduction in hospital readmissions.
Virtual consultations and triage	Nurses conduct virtual consultations, provide triage services, and offer expert advice through telehealth platforms.	Nurses assess patients' symptoms, provide guidance, offer education, and determine the appropriate level of care needed. Through tele-triage, nurses help patients access timely care, alleviate unnecessary emergency department visits, and optimize healthcare resources. Nurses are also involved in delivering telehealth education and coaching to patients on disease management, medication adherence, lifestyle modifications, and self-care techniques.
Telehealth nursing hotlines	Nurses staff telehealth nursing hotlines, providing 24/7 access to healthcare advice and guidance. They address nonemergency concerns, answer questions, and offer recommendations for self-care.	Telehealth nursing hotlines serve as a valuable resource for patients seeking immediate assistance and contribute to the efficient utilization of healthcare services.

TABLE 2.2 Nursing Roles in Telehealth and Technology

Nursing Role	What It Is	Why It Is Important
Collaboration and care coordination	Nurses play a central role in coordinating and facilitating virtual care team meetings, discussing patient care plans, and ensuring effective communication between healthcare professionals.	Telehealth facilitates collaboration and care coordination among healthcare providers. Nurses contribute their expertise, advocate for patients, and ensure continuity of care across various healthcare settings.
Health informatics and data analysis	Nurses with expertise in health informatics and data analysis are crucial in leveraging technology to manage and analyze large volumes of healthcare data. They use electronic health record (EHR) to document and access patient information, generate insights, and make evidence-based decisions.	Nurses play a vital role in ensuring accurate and meaningful data collection, contributing to quality improvement initiatives and research endeavors.

TABLE 2.2 Nursing Roles in Telehealth and Technology

Nursing Advocacy

Recent trends in nursing **self-advocacy** reflect a growing recognition among nurses of the importance of advocating for themselves, their professional rights, and their well-being. Self-advocacy refers to the proactive and assertive act of nurses advocating for their own well-being, professional growth, and rights within the healthcare system. Nurses are increasingly engaging in networking and working with professional organizations to amplify their voices and advocate collectively. They may join nursing associations and participate in local, national, and international nursing networks to share experiences, exchange ideas, and collaborate on initiatives. They may also utilize social media platforms and digital networks to connect, share information, and mobilize in support of each other. Regardless of the methods, more and more nurses are speaking up about the importance of work-life balance, self-care practices, and access to resources that support their emotional and psychological well-being.

A top priority is the creation of safe and healthy work environments that prioritize their well-being. Nurses are vocal about the importance of appropriate nurse-to-patient ratios, manageable workloads, and adequate rest breaks. Other important issues concern the implementation of policies and practices that prevent workplace violence, address bullying and harassment, and promote a culture of respect and support. Nurses also advocate for the implementation of wellness programs, access to mental health resources, and support services that address the unique stressors and challenges faced by nurses.

In addition to advocating for safer and more supportive work environments, nurses want more opportunities for professional growth and recognition. They seek fair compensation, benefits, and opportunities for career advancement, such as professional development programs, mentorships, and pathways for specialty certification.

2.2 Patient-Centered Care

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Define the fundamentals of patient-centered care
- Explain benefits of patient-centered care
- Describe ways in which patient-centered care is a more transparent form of healthcare delivery

Picture this: a patient walks into a hospital or clinic, feeling vulnerable and uncertain about what lies ahead. Suddenly, the patient is greeted by a team of healthcare providers who prioritize their unique needs, preferences, and values above all else. They listen attentively to the patient's concerns, involve the patient in decision-making, and tailor their care to align with the patient's goals. That is the power of patient-centered care. It goes beyond treating the physical symptoms: it recognizes that the patient is a whole person with individual emotions, needs,

and desires.

Patient-centered care puts the patient at the heart of the healthcare experience, empowering them to actively participate in their own care and leading to better outcomes, increased satisfaction, and a truly collaborative partnership with their healthcare team.

Fundamentals of Patient-Centered Care

A fundamental concept in nursing that places the patient at the forefront of healthcare delivery is **patient-centered care** (AACN, 2023). It recognizes the importance of understanding and respecting the unique needs, preferences, values, and beliefs of each individual patient. Patient-centered care takes a holistic view of the patient, considering their physical, psychological, emotional, and social well-being. Nurses assess and address not only the patient's medical condition but also their personal and psychosocial needs. This approach recognizes that patients are unique individuals with their own life experiences, values, and beliefs that impact their health and healthcare decisions.

Patient as a Team Member

Patient-centered care involves a collaborative approach in which nurses work together with patients, their families, and other interdisciplinary **team members**. Shared decision-making empowers patients to actively participate in their care by providing information, discussing treatment options, and jointly deciding on the best course of action as a member of their own healthcare team. Nurses act as advocates, facilitating communication between patients and other healthcare professionals.

Although the patient is a member of their own healthcare team, patient-centered care ultimately recognizes patient autonomy, or the concept that patients have the right to make decisions about their own health care. Each patient is unique, with distinct physical, emotional, and social needs. Nurses should respect patients' choices, values, and preferences and involve them in the decision-making process. This requires effective communication and active listening to understand and address the patient's concerns. Nurses should strive to provide personalized care that considers the patient's specific circumstances. This involves tailoring interventions, treatment plans, and education to meet the patient's individual needs, cultural background, and beliefs.

Communication is crucial in patient-centered care. Nurses should use clear and concise language, avoiding medical jargon, and ensure that patients understand the information provided. Active listening skills are essential to comprehend patients' concerns, fears, and expectations. Open and honest communication builds trust and fosters a therapeutic relationship between the nurse and patient. Respecting privacy and maintaining confidentiality are also integral aspects of patient-centered care.

PATIENT CONVERSATIONS

Patient-Centered Care in Treatment Plan Development

Scenario: Registered nurse (RN) walks into the patient's room. The patient just received news from the APRN that he has a diagnosis of chronic obstructive pulmonary disease (COPD). The RN is coming to talk to the patient about his new diagnosis, provide education, and help him establish an effective treatment plan.

Nurse: Hello, I'm going to be your nurse today. I understand you have COPD. Have you heard of COPD before?

Patient: Hello. I just got the news about having COPD, and honestly, it's hitting me hard. I used to love hiking and gardening, but now it feels like even simple tasks are a struggle.

Nurse: COPD can be tough, and it's normal to feel overwhelmed. One thing that's important is to stay active. Let's talk about your hobbies and activities. What is the one thing that matters most to you right now?

Patient: Well, I miss hiking more than anything. It has been a big part of my life, and I hate that it has become so difficult.

Nurse: I can tell how much hiking means to you. Let's work on a plan to get you back on the trails, one step at a time. First, we'll focus on managing your symptoms. We'll go over the medications and how to use them effectively

so you can breathe better.

Patient: Thank you. That's helpful, but I also know I need to quit smoking. I've tried a few times, but it has been really difficult.

Nurse: You're absolutely right. Quitting smoking is vital for managing COPD. I'll connect you with some written and online resources to make it easier. We can talk to your provider to see if medication is an appropriate option. We'll also talk about creating a smoke-free environment at home.

Patient: I appreciate that. But, let's get back to hiking. I miss it so much, and it feels like a huge part of who I am.

Nurse: I hear you. Hiking is a significant part of your life, and we'll work toward getting you back out there. We'll start with an exercise plan tailored to your abilities, gradually building your strength and lung capacity. I'll also provide techniques that you can use if you get short of breath during your hikes.

Patient: All of this sounds really helpful. But honestly, I'm worried I'll forget some of it. Is there a way we can put this plan down in writing?

Nurse: Of course! We'll create a personalized COPD action plan that outlines our goals and the steps we're taking. I'll make sure you have it in writing, along with some reliable resources for reference.

Patient: That sounds like a great plan. Thanks for being here for me and working on this together.

Nurse: You're welcome! Remember, I'm here to support you and your goals. Let's focus on getting you back on those hiking trails and enjoying the outdoors again.

Coordinated Health Care

Patient-centered care extends beyond individual encounters. Nurses should strive to provide continuity of care by promoting coordinated transitions between different healthcare settings and providers in order to improve patient outcomes. This includes clearly communicating patient information, practicing proper handoff procedures, and ensuring that patients feel supported throughout their healthcare journey. By promoting coordination and continuity, nurses help prevent fragmented and disjointed care.

Benefits of Patient-Centered Care

There are multiple benefits of patient-centered care, both for the patients and for other involved parties.

- It enhances the overall patient experience, leading to higher levels of satisfaction. Effective communication promotes trust and rapport between patients and healthcare providers. When patients feel respected, heard, and involved in their care, they are more likely to feel satisfied with the healthcare services they receive.
- It contributes to the job satisfaction of healthcare providers, including nurses. When nurses are able to establish meaningful connections with patients, collaborate in decision-making, and witness positive health outcomes, it can increase their professional fulfillment and motivation.
- It can lead to cost savings in the long run, although patient-centered care requires an investment of time and resources. By actively involving patients in their care and tailoring interventions to their needs, unnecessary tests, procedures, and hospital readmissions may be reduced. Additionally, improved adherence to treatment plans can prevent complications and the need for more expensive interventions.

LINK TO LEARNING

Another look at the details and benefits of patient-centered care (https://openstax.org/r/77PatientCenter) is presented in this brief but informative video.

Improved Patient Outcomes

When patients are actively involved in their care and their preferences are considered, it can lead to improved health outcomes. Patients who feel empowered and engaged are more likely to adhere to treatment plans, manage chronic conditions effectively, and achieve better overall health. Table 2.3 lists some ways in which patient-centered care leads to improved patient outcomes.

Outcome	Description	Example
Enhanced treatment adherence	Patients who are actively involved in their care and have a good understanding of their conditions and treatment options are more likely to adhere to prescribed treatments and medication regimens. This improved treatment adherence leads to better health outcomes and improved individual patient well-being.	A 67-year-old patient with type 2 diabetes actively participates in setting her treatment goals, collaborates with her healthcare team to make treatment decisions, receives comprehensive education, and follows a personalized care plan that aligns with her lifestyle. This patient-centered approach enhances her treatment adherence, resulting in better blood sugar control and improved overall health.
Increased patient safety	Patient-centered care encourages patients to ask questions, voice concerns, and provide important information about their health history and current conditions. This collaborative approach helps identify and address potential safety risks, reducing medical errors and improving patient safety.	A 43-year-old male patient is scheduled for a surgical procedure, and informed consent is a priority. The medical team thoroughly discusses the surgery, explaining risks and benefits in plain language. The patient's preferences, like anesthesia and pain management, are considered, and he actively participates in medication reconciliation. This approach enhances patient safety by ensuring clear communication, tailored care, and a comprehensive understanding of the procedure.
Enhanced patient communication and trust	Patient-centered care prioritizes clear and effective communication between healthcare providers and patients in order to build trust. Trusting relationships foster a safe environment for patients to ask questions, seek clarification, and actively participate in their care.	A 43-year-old female patient with a new breast cancer diagnosis visits her healthcare provider. During the routine checkup, the provider takes the time to actively listen to the patient's concerns regarding her cancer treatment options and the lifestyle challenges they encounter. They engage in a collaborative conversation about treatment options. Complex medical information is conveyed in a clear, understandable manner, with visual aids to assist with comprehension. Importantly, the patient's preferences, including dietary choices and exercise routines, are respected and integrated into the treatment plan. The provider listens patiently and with a nonjudgmental attitude. By respecting the patient's preferences, a sense of ownership over their health is cultivated, strengthening the patient-provider relationship. The ideal outcome is that the patient experiences enhanced communication and trust with their healthcare provider.

TABLE 2.3 Improved Patient Outcomes of Patient-Centered Care

Outcome	Description	Example
Patient empowerment and self-management	By providing education, information, and support, patients are equipped with the knowledge and tools to self-manage their conditions effectively. Empowered patients are more likely to engage in healthy behaviors, make informed decisions, and take responsibility for their own well-being.	A 73-year-old male patient is diagnosed with high blood pressure. A nurse provides education on practical tools and strategies for self-management. This includes guidance on meal planning, exercise routines, blood pressure monitoring, and medication adherence. The patient is encouraged to actively monitor his blood pressure, record his progress, and attend regular follow-up appointments. Regular follow-up appointments allow him to discuss his achievements, challenges, and any adjustments needed in his care plan. As a result of this patient-centered approach, the patient becomes increasingly empowered. He possesses the knowledge, skills, and confidence to make informed choices about his daily activities, diet, and medication. With the ongoing support and partnership of the nurse, the patient successfully manages his diabetes, achieving improved blood pressure control and an enhanced overall quality of life.
Improved patient satisfaction	Patient-centered care focuses on meeting the unique needs and preferences of each patient. By actively involving patients in their care, listening to their concerns, and respecting their values and choices, nurses help patients feel heard, valued, and respected. They are more likely to have positive experiences with their healthcare providers and increased overall satisfaction.	A 24-year-old female seeks care for a chronic health condition at a healthcare facility committed to patient-centered care. Upon arrival, the patient is greeted by a warm and empathetic receptionist who takes the time to ensure the patient is checked-in and ready for her appointment on time. During her consultation with the healthcare providers, the patient feels actively engaged in her care. Her treatment plan is developed collaboratively between the patient and her treatment team, incorporating her unique preferences and values. Her providers explain her condition and treatment options clearly, ensuring that she fully comprehends her choices. The patient feels respected and heard throughout this process. As the patient progresses through her treatment plan, she experiences consistent communication with her healthcare team, including follow-up calls and emails. This proactive approach assures the patient that her well-being is a top priority for the healthcare facility. The patient's overall experience reflects the principles of patient-centered care, where her values, needs, and preferences are honored. As a result, she not only experiences improved health outcomes but also expresses high satisfaction with her healthcare journey. Her confidence in the healthcare system grows, contributing to her commitment to the treatment plan.

TABLE 2.3 Improved Patient Outcomes of Patient-Centered Care

Improved Population Outcomes

Patient-centered care is a healthcare approach that prioritizes the individual patient's needs, preferences, and values. While its primary focus is on the individual patient, patient-centered care has a broader impact by improving the overall quality of care provided and promoting better health outcomes for the whole community. Table 2.4 lists some ways in which patient-centered care improves population outcomes.

Outcome	Description	Example
Enhanced preventive care and health promotion	Nurses work collaboratively with patients to develop personalized preventive strategies and educate them about disease prevention and health maintenance.	A nurse establishes regular community health fairs that offer free or low-cost health screenings, such as blood pressure checks, cholesterol tests, and glucose monitoring.
Improved access to care	Nurses advocate for equitable access to healthcare services, facilitate referrals, and help patients navigate the healthcare system.	A nurse helps set up a telemedicine center in a rural community, equipped with technology such as videoconferencing equipment and diagnostic tools like digital stethoscopes and remote monitoring devices.
Reduction of health disparity	Nurses recognize that different populations may face varying healthcare challenges and provide individualized care to address these disparities. Nurses understand and respect diverse patient needs and cultural backgrounds.	A nurse creates a community program that collaborates with local farmers' markets to provide fresh, affordable produce to low-income residents. Cooking classes are also offered to teach healthy meal preparation on a budget.
Empowerment of communities	Nurses collaborate with community leaders and organizations, educate communities about health promotion and disease prevention, and facilitate access to resources.	A neighborhood has limited access to fresh, healthy food options and a lack of green spaces. The residents in this community have expressed a desire for better nutrition and a stronger sense of community. A nurse helps establish a community-led urban garden initiative to address these concerns and empower the residents.
Feedback and quality improvement	Nurses actively seek patient input, listen to their concerns, and use their feedback to make necessary improvements in care delivery.	A nurse works at a community health clinic. The nurse institutes a program for the clinic where multiple ways are given for patients to provide feedback, including suggestion boxes, online surveys, and in-person feedback sessions. The goal is to make it easy for patients to share their experiences and suggestions.

TABLE 2.4 Improved Population Outcomes of Patient-Centered Care

Transparency of Healthcare Information

Patient-centered care emphasizes the importance of providing patients with accurate, understandable, and relevant information about their health conditions, treatment options, and care plans. This includes discussing risks, benefits, and alternatives to treatment in a transparent manner. Using **transparent communication** ensures that patients have the necessary information to make autonomous decisions about their care. This approach ensures that patients are fully informed and actively involved in all relevant decisions. By empowering patients with knowledge, nurses can ensure that they actively participate in decision-making and have a clear understanding of their healthcare journey.

Use of Technology

Modern technology facilitates patient-centered care by making it easier for patients to access their medical records, test results, and other relevant health information. This transparency allows patients to review their healthcare information, verify its accuracy, and actively participate in discussions about their care. Access to medical records enables patients to stay informed, engage in meaningful conversations with healthcare providers, and make

informed decisions.

Better Resource Allocation

One broader benefit of transparent communication is that it can contribute to improved **resource allocation** in a number of ways. Resource allocation refers to the equitable and efficient distribution of healthcare resources to meet the diverse healthcare needs of patients and communities. When patients can easily access information about healthcare services, costs, and outcomes, they can make more informed decisions about their treatment options. This allows the patient to consider the value and cost-effectiveness of different interventions and choose the most appropriate and cost-efficient course of action. In addition, transparent healthcare information enables patients to understand their medical history, test results, and treatment plans. With access to this information, patients can effectively communicate with healthcare providers, reducing the risk of duplicate or otherwise unnecessary tests or procedures. Informed decision-making thus reduces unnecessary utilization of resources on treatments that may not provide significant benefits, thereby optimizing resource allocation.

Transparent communication holds healthcare systems, providers, and payers accountable for their resource allocation decisions. When patients have access to information about costs, quality, and outcomes, the monitoring and evaluation of healthcare services are facilitated. This transparency can drive providers and healthcare systems to optimize their resource allocation, improve efficiency, and deliver value-based care.

Increased transparency of healthcare information also enables patients to compare prices, quality, and outcomes across different providers or healthcare organizations. It allows them to compare such factors as accreditation standards and hospital rankings. This promotes competition and market forces within the healthcare system, as providers strive to deliver high-quality care at competitive prices. This competitive environment can incentivize providers to allocate resources efficiently and improve the value of services they offer.

2.3 Practice Standards

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the practice standards that make nursing a professional discipline
- Identify the scope of professional nursing practice standards
- Explain the practice standards for nursing delegation

The ANA maintains Standards of Professional Nursing Practice and updates them regularly. These standards are like a trusty map, leading you through the maze of the nursing profession with a dedication to safety, ethics, and excellence as your compass. They provide a foundation for you to make critical decisions and provide safe and ethical care, and empower you to be the advocate, decision-maker, and healer your patients need, while upholding the values of professionalism, compassion, and integrity that define the nursing profession.

Standards of Nursing as a Professional Discipline

As a professional discipline, nursing adheres to a set of standards that guide and govern nursing practice. The ANA's Standards for Professional Nursing Practice are more than just a set of rules, however: they are the framework for delivering quality care, ensuring that you are equipped with the knowledge and tools to make a positive impact on your patients' lives (ANA, 2021).

The ANA standards are divided into two main parts. The first six, which ANA calls Standards of Practice, are concerned with the **nursing process**. They are meant to guide nurses in delivering safe, effective, and holistic care using a systematic approach and critical thinking. Table 2.5 provides more details about these first six standards.

Standard	Component of Nursing Process	Example
1	Assessment	Asking a patient if they are in pain and asking them to rate it on a scale of 0–10.
2	Diagnosis	Giving a patient who is awaiting surgery a nursing diagnosis of "Risk for Acute Pain related to scheduled orthopedic surgery as evidenced by patient's preoperative history of chronic joint pain and planned surgical intervention."
3	Outcomes identification	The nurse identifies a patient outcome of "The patient will report pain levels of 3 or lower on a 0–10 pain scale within 24 hours postsurgery."
4	Planning	The nurse develops and implements an individualized pain management plan for the patient postsurgery, which includes monitoring pain levels, administering pain medications as ordered, educating the patient on pain management techniques, and evaluating the effectiveness of pain relief interventions.
5	Implementation 5A. Coordination of Care 5B. Health Teaching and Health Promotion	During the 24-hour period following surgery, the nurse administers pain medication to the patient according to the prescribed schedule and monitors the patient's vital signs, including respirations and blood pressure, regularly to ensure pain relief and early detection of any complications. They educate the patient on safe use of pain medications and when to call the nurse for assistance.
6	Evaluation	After implementing the pain management plan for a postsurgical patient, the nurse assesses the patient's pain level on a 0–10 scale and evaluates the effectiveness of pain relief interventions. If the patient reports a pain level of 3 or lower, and pain behaviors like grimacing have decreased, the pain management plan is considered effective. If not, the plan will be reviewed and adjusted as needed in consultation with the healthcare team.

TABLE 2.5 Standards of Practice

In addition to the six Standards of Practice, the ANA identifies 11 Standards of Professional Performance. These standards are meant to ensure that nurses maintain competent behavior in their professional role. Table 2.6 provides more details about these standards.

Standard	Component of Professional Performance	Example
7	Ethics	A nurse works at a hospital and has a friend who is admitted as a patient to that same hospital. The friend's spouse asks to see the medical record belonging to the nurse's friend. The nurse declines to share the patient record until they speak with their friend, in order to avoid breaking patient confidentiality.
8	Culturally congruent practice	A nurse caring for a Muslim patient who is fasting during Ramadan ensures that the patient's medications are scheduled and administered before sunrise and after sunset when the patient is allowed to eat and drink.
9	Communication	A nurse uses clear and simple language free of medical jargon to explain an upcoming MRI to a patient and their family. The nurse encourages questions and actively listens to ensure the patient and family fully understand the procedure, its risks, and its benefits, promoting informed decision-making and reducing anxiety.
10	Collaboration	A nurse conducts bedside handoff by involving both the outgoing and incoming shifts of nurses. They discuss the patient's condition, care plan, and any concerns openly and collaboratively, ensuring accurate and continuous care transition while also involving the patient in the conversation when appropriate.
11	Leadership	An experienced nurse takes the initiative to mentor and guide new nurses on their unit, providing them with constructive feedback, sharing best practices, and encouraging their professional development. This leadership fosters a supportive and learning-oriented environment within the nursing team.
12	Education	A nurse participates in an interactive online module on the topic of pain management for continuing education credit.
13	Evidence-based practice and research	A nurse working in an oncology unit reviews the latest research studies on pain management for cancer patients. They discover a recent study suggesting that mindfulness meditation can significantly reduce pain and improve the well-being of cancer patients. The nurse collaborates with the healthcare team to implement mindfulness meditation as an evidence-based intervention in the unit's pain management protocols and continuously evaluate its effectiveness with patients.
14	Quality of practice	A nursing unit identifies an increase in the number of patient falls. The nursing team collects data on fall incidents, analyzes trends, and conducts interviews with patients and staff to identify contributing factors. They discover that poor lighting in certain areas and inadequate patient education about fall risks are key issues. In response, the nursing unit implements improved lighting fixtures and initiates a comprehensive patient education program on fall prevention. As a result, the rate of patient falls significantly decreases.

TABLE 2.6 Standards of Professional Performance (Source: ANA, 2021.)

Standard	Component of Professional Performance	Example
15	Professional practice evaluation	A nursing manager conducts a regular performance evaluation of nurses on their unit. During the evaluation, they review the nurses' adherence to infection control protocols, documentation accuracy, communication skills, and overall patient care. This evaluation process helps identify areas for improvement and professional growth, contributing to the nurses' ongoing development and ensuring high-quality nursing practice within the unit.
16	Resource utilization	A nurse working in an outpatient clinic efficiently organizes patient appointments, ensuring that time slots are optimally utilized and patient wait times are minimized. By effectively allocating appointment slots and coordinating patient flow, the nurse maximizes the utilization of available resources while providing timely care to patients.
17	Environmental health	In a long-term care facility, a nurse takes steps to maintain a safe and healthy environment for older adult residents. They conduct routine checks for potential hazards, such as slippery floors or tripping hazards, promptly address issues like mold or mildew, and ensure that proper ventilation and air quality standards are maintained.

TABLE 2.6 Standards of Professional Performance (Source: ANA, 2021.)

Education for Licensure

Education for licensure in nursing involves completing a formal nursing education program that prepares individuals to become RNs. There are two common educational paths to RN licensure in the United States: Associate Degree in Nursing (ADN) programs and Bachelor of Science in Nursing (BSN) programs.

Associate Degree in Nursing programs provide a foundation in nursing knowledge and skills, combining classroom instruction with clinical experiences. Bachelor of Science in Nursing programs include ADN curriculum while also providing a comprehensive education in nursing, including theoretical knowledge, research skills, and clinical experiences. Bachelor of Science in Nursing programs often incorporate courses in the natural and social sciences, as well as additional coursework in areas such as leadership, community health, and evidence-based practice. Upon completion of the ADN or BSN program, graduates must pass a licensure examination called the National Council Licensure Examination for Registered Nurses (NCLEX-RN) in order to become an RN. If desired, the RN may then continue with their education for APRN with more formal specialized training.

Scope of Nursing Practice

The ANA **Scope of Nursing Practice** defines the boundaries, responsibilities, and expectations of nursing professionals in their respective roles (ANA, 2021). It outlines the specific activities, interventions, and decision-making processes that nurses are authorized and qualified to perform within their jurisdiction. By defining these roles and responsibilities, the Scope of Nursing Practice serves several purposes.

LINK TO LEARNING

The ANA's Scope of Practice (https://openstax.org/r/77ANAScopePrac) describes the "who," "what," "where," "when," "why," and "how" of nursing practice (ANA, n.d.).

Clearly defining the activities and interventions that nurses are competent to perform may help prevent nurses from engaging in practices beyond their scope of knowledge and skills, thereby minimizing the risk of errors, adverse events, and harm to patients. It also helps establish professional boundaries by clarifying the limits of nursing

practice and ensures that nurses understand both the extent of their role and responsibilities and the appropriate times to seek assistance or refer patients to other healthcare professionals. This helps maintain clarity and accountability in nursing practice.

The Scope of Nursing Practice also sets standards for quality and consistency in nursing care. It ensures that nurses possess the necessary competencies, qualifications, and knowledge to provide safe and effective care. By adhering to the defined scope, nurses contribute to the delivery of evidence-based, standardized care that meets the needs of patients and promotes positive health outcomes. Additionally, the scope provides a foundation for nursing education and professional development. It helps shape nursing curricula, ensuring that educational programs equip students with the necessary knowledge and skills to practice within their field of study. It also guides nurses in identifying areas for further education and specialization, promoting lifelong learning and professional growth.

Another purpose of the Scope of Nursing Practice is to protect the public and regulate the nursing profession. It helps establish legal and regulatory frameworks that govern nursing practice, ensuring that nurses adhere to ethical standards, maintain competence, and provide safe and ethical care. It also provides a basis for licensure, certification, and disciplinary processes that maintain professional accountability and public trust.

Finally, the Scope of Nursing Practice facilitates collaboration and fosters positive relationships among healthcare professionals. It delineates areas of overlap and collaboration with other members of the healthcare team, promoting effective communication, coordination, and shared decision-making. This leads to improved patient outcomes and a more holistic approach to care.

REAL RN STORIES

Remaining Within Your Scope of Practice

Nurse: Johanna, RN
Clinical setting: Emergency department of a small, rural hospital
Years in practice: 2
Facility location: Pennsylvania

As an RN who works in the emergency department, I often encounter various situations that demand quick thinking. One day I found myself in a situation where a concerned family member asked me to interpret a brain MRI scan for their loved one who was being treated for a head injury.

The family member was visibly worried and eager for answers. They asked me to look up the patient's chart on my computer and review the MRI images and explain what was happening. I understood their anxiety, but I knew that interpreting radiological images, such as MRIs, fell outside the scope of my nursing practice.

I explained to the family member that while I could provide information about the patient's overall condition and care plan, I wasn't qualified to interpret the MRI scan accurately. Radiology interpretation requires specialized training and expertise and is usually provided by radiologists.

I let the family member know that our healthcare team would ensure that the MRI results were reviewed by a qualified specialist as soon as possible who could provide a detailed interpretation. I also mentioned that the attending physician would discuss the findings and treatment plan with them once the interpretation was available.

While the family member seemed disappointed, they appreciated my honesty and understanding. They understood that my primary role was to provide safe and compassionate nursing care, and I had their loved one's best interests in mind by ensuring that the MRI was reviewed by the appropriate specialist. This experience reinforced the importance of staying within the boundaries of my scope of practice.

Decision-Making Framework

The Scope of Nursing Practice Decision-Making Framework was developed by professional nursing organizations as a tool for nurses and others to determine what actions a nurse may safely perform (Ballard et al., 2016). It guides nurses in navigating complex situations, ensuring that their actions align with their scope of practice and adhere to ethical and legal standards. The tool is intended for use by direct care nurses, managers, educators, administrators,

researchers, and others.

LINK TO LEARNING

This web page, created by the National Council of State Boards of Nursing (NCSBN), illustrates the decision-making framework for nurses (https://openstax.org/r/77DecisionFrame) and also provides information about the framework's development.

Practice Standards for Delegation

An essential nursing skill, **delegation** involves assigning a task to another person who has the appropriate knowledge, skills, and competence to perform that task (ANA & NCSBN, 2019). The delegating nurse retains responsibility and accountability for the outcome of the delegated task. Delegation allows nurses to distribute workload, prioritize care, and optimize efficiency (Table 2.7). By utilizing the skills and capabilities of other members of the healthcare team, it helps ensure that patient needs are met. However, the RN may not delegate tasks related to making nursing judgments, critical decision-making, or clinical reasoning such as initial assessment, evaluation, teaching, and advanced training.

Assessment and planning	Evaluate needs and plan for delegation.
Task and delegate selection	Choose appropriate tasks and qualified individuals.
Communication and resource provision	Ensure clear communication and necessary resources.
Supervision and evaluation	Oversee task completion and assess outcomes.
Documentation and accountability	Maintain records and ensure accountability.

TABLE 2.7 **Key Steps of Nursing Delegation**

Five Rights of Nursing Delegation

The ANA's "Five Rights" of nursing delegation are a framework that helps guide the delegation process and ensure safe and effective care delivery (ANA, 2019). These rights provide a systematic approach to delegation and help nurses make informed decisions about assigning tasks to other healthcare team members. Table 2.8 lists the Five Rights of Delegation.

Right	What the Right Entails
Right task	The task must be appropriate for delegation.
Right circumstance	The circumstances must be appropriate for delegation.
Right person	The individual must be able to perform the task.
Right communication	The instructions regarding the task must be clear.
Right supervision	The individual performing the task must be properly supervised.

TABLE 2.8 **Rights of Nursing Delegation**

Right Task

The first right of delegation is ensuring that the task being delegated is appropriate for delegation. The task should be one that can be safely and effectively performed by the delegate based on their education, training, and competence. It may not be a task related to clinical reasoning, nursing judgment, or critical decision-making.

Right Circumstance
The second right of delegation involves considering the circumstances under which the task is being delegated. Nurses must evaluate factors such as the patient's condition, stability, and complexity of care needs, as well as the availability of resources and support. Delegation should be appropriate given the specific situation and the delegate's ability to carry out the task effectively. For example, delegation of basic care to a critically unstable patient would not be appropriate; this task should be performed by the nurse in case the patient's condition changes rapidly.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety: Delegation

Disclaimer: Always follow the agency's policies regarding delegation.

Definition: This competency centers on nurses' capacity to correctly employ a structured decision-making framework in their practice. It ensures that nurses have the necessary knowledge, skills, and attitudes to make informed, evidence-based decisions that optimize patient outcomes while considering patient preferences, values, and ethical principles.

Knowledge Areas:

- Clinical Judgment: Nurses should possess a deep understanding of clinical judgment, enabling them to assess patient data, discern patterns, and make informed decisions rooted in the best available evidence.
- Evidence-Based Practice: Competency in evidence-based practice involves the ability to integrate current research findings into decision-making, ensuring the delivery of the most effective and up-to-date care.
- Ethical and Legal Principles: Nurses must be well-versed in ethical and legal considerations to navigate complex ethical dilemmas and adhere to regulatory standards in their decision-making.

Skill Areas:

- Critical Thinking: Proficiency in critical thinking is essential for evaluating and analyzing information, identifying potential risks, and weighing the benefits and drawbacks of various interventions.
- Communication and Collaboration: Effective communication with the healthcare team, patients, and their families is vital in decision-making. Nurses should actively engage in interprofessional collaboration to ensure comprehensive patient care.
- Patient-Centered Care: Nurses should involve patients in the decision-making process, considering their values, preferences, and cultural background to develop a care plan that aligns with the patient's goals and needs.

Attitudes:

- Patient Advocacy: Nurses should uphold a commitment to patient advocacy, ensuring that patients' voices are heard and their choices respected in the decision-making process.
- Lifelong Learning: Embracing a commitment to lifelong learning is essential, enabling nurses to stay updated with advances in health care and evolving best practices to continuously improve their decision-making skills.

Right Person
The third right of delegation focuses on selecting the appropriate individual to whom the task will be delegated. Nurses should assess the delegate's knowledge, skills, and competence in performing the delegated task. Consideration should be given to their experience, training, and ability to handle the specific task safely and effectively. For example, nurses will not delegate medication administration to unlicensed assistive personnel (UAP), as that is not within their scope of practice.

Right Communication
The fourth right of delegation emphasizes the importance of clear and effective communication. Nurses must provide clear instructions and guidelines to the delegate regarding the task to be performed. This includes explaining the purpose and desired outcomes as well as any specific instructions and potential risks or precautions

associated with the task. Communication should be ongoing and include feedback and clarification as needed.

Right Supervision

The final right of delegation involves appropriate supervision and evaluation of the delegated task. Nurses maintain responsibility for overseeing and evaluating the care provided by the delegate. They must provide ongoing support, guidance, and feedback, and monitor the delegate's performance to ensure the task is carried out safely and effectively. Regular communication and follow-up are essential to ensure the task is completed satisfactorily and any necessary adjustments are made.

CLINICAL JUDGMENT MEASUREMENT MODEL

Generate Solutions: Deciding When It Is Appropriate to Delegate

Generating solutions involves identifying the different actions or interventions available to address a patient issue. This requires recognizing which solutions are indicated and/or effective, and which are unnecessary or contraindicated. Delegating care is a critical part of generating solutions in nursing, as multitasking and prioritizing remain consistent top priorities. The Five Rights of Delegation provide a framework for critical thinking to assist the nurse in the delegation process. For example, a nurse has a patient who needs their blood glucose checked just prior to a meal, but another patient's heart rate has suddenly dropped from the 80s to the 40s on the telemetry monitor. There is a UAP available to help, and the nurse uses the Five Rights of Delegation to determine that they will go check on the patient with the low heart rate, the critical situation, while the UAP checks the blood glucose of the other patient.

2.4 Collaborative Care

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the collaborative care approach to health care
- Define the fundamentals of collaborative care
- Recognize the benefits of collaborative care

Imagine a group of healthcare professionals coming together like well-coordinated musicians, each with their own instrument to play, creating beautiful music together. That is the idea behind collaborative patient care. Each member of the team—the patients, nurses, physicians, pharmacists, therapists, and other healthcare workers—brings their unique expertise and skills to the table, with the strengths of all team members combining to make a unit that is stronger as a whole.

In the collaborative model, healthcare professionals work hand in hand, sharing information, bouncing ideas off each other, and making decisions as a collective force. It is like a brainstorming session where everyone's voice is heard, valued, and respected. Together, the providers create care plans that consider not just the physical aspects of health but also the emotional, social, and mental well-being of each specific patient. The collaborative model is about putting the patient front and center and tailoring the care to their individual needs, preferences, and goals. If you embrace the collaborative approach to patient care, you will learn to work with a diverse team of healthcare professionals, building a solid foundation of teamwork and making a difference in the lives of those you serve.

Collaborative Approach to Patient Care

The **collaborative model** of patient care in nursing emphasizes the importance of interdisciplinary teamwork and effective communication among healthcare professionals to provide holistic, patient-centered care. This approach recognizes that multiple healthcare disciplines contribute unique perspectives and expertise to address the complex needs of patients. It is especially beneficial for patients with complex and/or chronic conditions. In the collaborative approach, nurses collaborate with other healthcare professionals, such as physicians, pharmacists, therapists, social workers, and case managers, as well as patients and their families to form interdisciplinary teams (Morley & Cashell, 2017). These teams work together to develop comprehensive care plans, make shared decisions, and coordinate care across different settings and disciplines. By pooling their knowledge and skills, healthcare professionals can provide a more comprehensive and coordinated approach to patient care.

Effective communication is essential for collaborative patient care. Nurses play a critical role in facilitating the collaborative care process by ensuring that patients and their families are well-informed about their conditions, treatment options, and potential outcomes. They help patients understand the risks and benefits of different interventions and support them in making decisions that align with their values, preferences, and goals. Nurses must also communicate clearly, actively listen, and exchange relevant information with other healthcare professionals. This includes sharing patient assessments, treatment plans, and progress updates. Additionally, nurses facilitate communication between different team members, ensuring that everyone has access to the necessary information to provide optimal care.

Team Member Roles in Collaborative Care

In a collaborative approach, each healthcare professional's role and expertise are valued and respected. Nurses work collaboratively with other team members, recognizing the unique contributions of each discipline. This includes acknowledging and appreciating the expertise, perspectives, and responsibilities of other healthcare professionals involved in the patient's care. Table 2.9 describes the roles of common team members.

Team Members	Who They Are	What They Do
Physicians and advanced practice registered nurses (APRNs), or providers	People with medical expertise and diagnostic skills, including primary care physicians, APRNSs, and physician assistants	Providers collaborate with other team members to develop treatment plans, interpret test results, and make clinical decisions. They diagnose and treat medical conditions, prescribe medications, order tests and procedures, and provide medical guidance and consultations.
Pharmacists	People with expertise in medication management	Pharmacists collaborate with the team to assess the appropriateness and effectiveness of medication regimens and provide recommendations for adjustments or alternatives. They review medication orders, ensure appropriate dosages and drug interactions, provide medication counseling, and offer guidance on optimizing drug therapy.
Therapists	People with expertise in various forms of therapy, including physical therapists, occupational therapists, and speech-language pathologists	Therapists assess and treat patients with physical, cognitive, or communication impairments. They provide therapeutic interventions, develop rehabilitation plans, and work closely with other team members to coordinate care and promote optimal functional outcomes.
Social workers	People with expertise in locating resources necessary to support patients' social and emotional needs	Social workers collaborate with other team members to address social determinants of health and ensure the patient's overall well-being. They assess psychosocial factors, provide counseling and emotional support, assist with care transitions, and connect patients with community resources and support services.

TABLE 2.9 Members of a Collaborative Care Team (Source: ANA, 2017.)

Team Members	Who They Are	What They Do
Case managers	People with expertise in overseeing the coordination and continuity of care for patients	Case managers help ensure smooth transitions across different care settings and support patients in navigating them. They assess patient needs, develop care plans, coordinate services, facilitate communication among team members, and monitor patient progress.
Allied health professionals	Other allied health professionals, such as dietitians, respiratory therapists, psychologists, and counselors, who contribute their specialized knowledge and skills as needed	Allied health professionals collaborate with the team to develop and implement targeted interventions and support patient well-being. They assess and address specific patient needs related to nutrition, respiratory health, mental health, and other areas.

TABLE 2.9 Members of a Collaborative Care Team (Source: ANA, 2017.)

Nursing Role in Collaborative Care

Nurses play a central role in collaborative care. They provide direct patient care, coordinate and manage care plans, and act as liaison between the patient, their family, and other healthcare professionals. Nurses assess patient needs, implement interventions, monitor outcomes, and provide education and support. They also facilitate communication and collaboration among team members, ensuring the delivery of coordinated and holistic care.

Nurses often take a lead role in coordinating the various aspects of patient care. They serve as a central point of contact, ensuring that communication flows smoothly among team members, facilitating consultations or referrals, and organizing multidisciplinary meetings. Nurses work closely with patients, their families, and other healthcare professionals to create care plans that address the physical, emotional, social, and spiritual needs of the patient.

LINK TO LEARNING

This video about https://www.youtube.com/watch?v=hZZ3cKu8XHA]collaborative care (https://openstax.org/r/77CollabCare) discusses the benefits of the collaborative care approach for patients and the central role of nurses in this care model.

Fundamentals of Collaborative Care

Collaborative care in modern health care is built on several fundamental principles, which include organized communication, effective data sharing, simplified referrals, and integrated scheduling of care. This patient-centric approach relies on various healthcare professionals working together, across disciplines, to ensure comprehensive and coordinated patient care. The objective is to optimize patient outcomes, enhance the quality of care, and improve the overall healthcare experience by harnessing the collective expertise of a multidisciplinary team. By emphasizing organized communication, streamlined data sharing, simplified referrals, and integrated scheduling of care, collaborative care strives to address the complexities of modern health care and provide holistic and efficient care to individuals and communities. In this discussion, we explore these key fundamentals and their vital role within the healthcare landscape.

Organized Communication

Effective communication is essential for collaborative care. Healthcare professionals must communicate clearly, openly, and respectfully with each other, sharing relevant information, observations, and recommendations. Key skills include actively listening, effectively sharing information, and maintaining open lines of communication to foster collaboration and ensure the best possible care for the patient.

Effective Data Sharing

Successful collaborative care relies on effective data sharing to ensure that relevant patient information—such as medical history, diagnoses, medications, and treatment plans—is shared accurately and in a timely manner. This allows healthcare professionals to have a comprehensive understanding of a patient's health status, facilitating coordinated and informed decision-making. To ensure effective data sharing in collaborative care, healthcare systems need robust infrastructure for interoperable EHRs, secure data exchange protocols, and other key technologies, and providers must strictly adhere to privacy and security regulations. Policies and standards for data sharing, consent, and patient privacy must be in place to protect patient information while facilitating seamless collaboration among healthcare professionals.

Simplified Referrals

Care coordination encompasses activities such as scheduling appointments, sending referrals, and sharing information. A **simplified referral** in health care is a straightforward process where a healthcare provider recommends or directs a patient to see another healthcare specialist or receive specific medical services and typically involves minimal administrative steps to ensure timely and efficient care coordination. Simplified referrals help expedite patients' access to specialty care. By streamlining the referral process, unnecessary waiting times can be reduced, ensuring that patients receive timely appointments and necessary interventions. This is particularly important for patients with complex or specialized healthcare needs, as delays in accessing specialty care can have a significant impact on their health outcomes. Simplified referrals also lead to better continuity of care, improved communication, more efficient resource utilization, and enhanced patient satisfaction.

PATIENT CONVERSATIONS

Using Simplified Referrals to Help Patients Access Care

Scenario: Nurse walks into the patient's room to discuss the referral process for a specialist.

Nurse: Good morning! I will be your nurse today. How are you feeling?

Patient: Hello, I'm not doing so well. My knee has been bothering me a lot, and I can hardly walk without pain.

Nurse: I'm sorry to hear that. Let's see what we can do to help you. The nurse practitioner wants to refer you to an orthopedic specialist for a closer look at your knee.

Patient: Oh, okay. That sounds a little overwhelming. I don't think I know any specialists in this city, and I don't know who is covered by my insurance. Is this going to be a long process for the referral?

Nurse: Not at all. We've made this process simpler for our patients. We have an orthopedic specialist right here in the same building. I will send the referral over electronically and can arrange an appointment for you later this week. Would that work for you?

Patient: That's great! I was worried it would take a long time. Thank you for making it easy.

Nurse: You're welcome. We want to ensure you get the care you need as quickly as possible. I'll get everything set up, and you'll be seeing the orthopedic specialist soon.

Integrated Scheduling of Care

Implementing **integrated scheduling** of care focuses on optimizing the coordination and timing of healthcare services to improve patient outcomes and enhance the efficiency of care delivery. This involves coordinating appointments for patients with different healthcare providers in order to ensure smooth transitions, minimize wait times, and avoid unnecessary delays or conflicts. Coordinated appointments help streamline the patient's journey through the healthcare system, reducing the burden of scheduling and transportation on the patient and their caregivers, preventing gaps in care, and supporting the ongoing management of chronic conditions.

Integrated scheduling also helps providers use healthcare resources more effectively. By coordinating the schedules of healthcare professionals and aligning them with the availability of facilities, equipment, and support staff, integrated scheduling helps maximize the efficiency and productivity of healthcare services. It reduces idle time, minimizes conflicts or overlaps in schedules, and ensures that resources are utilized effectively to meet the

needs of patients.

Benefits of Collaborative Care

Collaborative care in health care, involving coordinated efforts among various healthcare providers, offers numerous benefits. It enhances the quality of care by allowing multiple disciplines to contribute their expertise, leading to more accurate diagnoses and tailored treatment plans. Additionally, it often results in reduced costs of care as unnecessary tests or treatments can be minimized through shared decision-making and resource optimization. Collaborative care also increases the convenience of care for patients as they can receive multiple services in one location or through coordinated telehealth consultations, reducing travel and waiting times. Ultimately, this collaborative approach fosters a patient-centered healthcare ecosystem that prioritizes both the effectiveness and efficiency of care delivery.

Improved Quality of Care

Collaborative care places the patient at the center of decision-making and care planning. Healthcare professionals from different disciplines collaborate to address the physical, emotional, social, and psychological needs of patients. This patient-centered approach ensures that care is tailored to the individual's preferences, values, and goals. By involving patients in the decision-making process and considering their unique circumstances, collaborative care promotes greater patient satisfaction and engagement.

Collaborative care has also been shown to improve patient outcomes. When healthcare professionals work together, they can provide a more holistic and coordinated approach to patient care. By leveraging their collective expertise, they can better assess patient needs, develop comprehensive care plans, and implement appropriate interventions. Collaborative care has been associated with improved patient satisfaction, reduced hospital readmissions, better management of chronic conditions, and enhanced overall health outcomes in both preventive and acute care.

Reduced Cost of Care

Collaborative care optimizes the use of healthcare resources and promotes efficiency in care delivery. By leveraging the expertise of different healthcare professionals, tasks can be delegated to the most appropriate team members, allowing each professional to practice within the full scope of their profession. This leads to a more efficient use of resources and streamlines workflows. Collaboration also helps avoid unnecessary tests, procedures, and consultations, reducing healthcare costs and optimizing resource allocation.

Collaborative care has the potential to improve the overall efficiency and effectiveness of the healthcare system. By providing comprehensive and coordinated care, collaborative teams can reduce healthcare utilization, prevent unnecessary hospital admissions or readmissions, and optimize resource allocation. The streamlined workflows, enhanced communication, and shared decision-making in collaborative care contribute to a more efficient and cost-effective healthcare system.

Increased Convenience of Care

Collaborative care can improve access to a wide range of healthcare services. By working together, healthcare professionals can efficiently coordinate appointments, referrals, and consultations. This reduces wait times and ensures that patients receive timely and appropriate care. Improved access to services is particularly beneficial for patients with complex or multiple healthcare needs, as collaborative care streamlines the process and minimizes unnecessary delays or duplication of services.

Summary

2.1 Changing with Trends

Although nursing practices have existed in human communities for thousands of years, it was not until Florence Nightingale's efforts during the Crimean War, in the mid-1800s, that nursing progressed into a professional discipline. Nightingale emphasized the importance of hygiene, nutrition, and evidence-based practice, and she later opened the first school of nursing.

Current nursing trends include integrating the latest healthcare technologies into education, emphasizing diversity and inclusion, and improving staffing ratios and working conditions for nurses. Future trends for nursing professionals include an emphasis on nursing self-care, the expansion of nursing roles in telehealth, and nursing advocacy.

2.2 Patient-Centered Care

Patient-centered care is a fundamental concept in nursing that places the patient at the forefront of healthcare delivery. It recognizes the importance of understanding and respecting the unique needs, preferences, values, and beliefs of each individual patient. Patient-centered care ultimately recognizes patient autonomy, or the concept that patients have the right to make decisions about their own health care. Patient-centered care has many benefits, including improved communication, increased trust between the patient and healthcare team, personalized care plans, and better outcomes. Additional benefits include enhanced overall patient experience, leading to higher levels of satisfaction; improved job satisfaction of healthcare providers, including nurses; and long-term cost savings.

Transparent communication is a necessary part of patient-centered care and ensures that patients have the necessary information to make autonomous decisions about their care. This approach ensures that patients are fully informed and actively involved in decisions about their health care, fostering transparency in the decision-making process. By empowering patients with knowledge, nurses can ensure that they actively participate in decision-making and have a clear understanding of their healthcare journey.

2.3 Practice Standards

As a professional discipline, nursing adheres to a set of standards, developed by the ANA, called the Standards for Professional Nursing Practice. These standards guide and govern nursing practice and professionalism. The ANA's Standards for Professional Nursing Practice are also the framework for delivering quality care, ensuring that nurses are equipped with the knowledge and tools to make a positive impact on patients' lives (ANA, 2021).

The ANA standards are divided into two main parts: the first six, which ANA calls Standards of Practice, are concerned with the nursing process; the Standards of Practice ensure that nurses provide safe, competent, and ethical care to their patients; the Standards of Professional Performance ensure that nurses maintain competent behavior in their professional role. The ANA has also created a Scope of Nursing Practice to define the boundaries, responsibilities, and expectations of nursing professionals in their respective roles. These include delegation, a crucial nursing responsibility. The five rights of nursing delegation were developed to serve as a framework for delegation; they are right task, right circumstance, right person, right communication, and right supervision.

2.4 Collaborative Care

The collaborative approach to patient care in nursing emphasizes the importance of interdisciplinary teamwork and effective communication among healthcare professionals to provide holistic, patient-centered care. This approach recognizes that multiple healthcare disciplines contribute unique perspectives and expertise to address the complex needs of patients. The fundamentals of collaborative care include organized communication, effective data sharing, simplified referrals, and integrated scheduling. Collaborative care has many benefits including improved quality of care, reduced cost of care, and increased convenience of care.

Key Terms

advanced practice registered nurse (APRN) an APRN is a professional nurse with specialized, advanced education to provide health care to specific patient populations

burnout a psychological phenomenon characterized by emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment related to one's work

collaborative model an approach to patient care that emphasizes the importance of interdisciplinary teamwork and effective communication among healthcare professionals to provide holistic, patient-centered care

compassion fatigue the emotional and physical exhaustion that results from providing empathetic care to those experiencing trauma or suffering

delegation the act of assigning a task to another person who has the appropriate knowledge, skills, and competence to perform that task

diversity, equity, and inclusion (DEI) the commitment to recognizing and embracing differences, ensuring fairness, and fostering a sense of belonging for all individuals in order to create a more equitable and enriched nursing profession and healthcare system

integrated scheduling the practice of coordinating appointments for patients with different healthcare providers involved in their care

interprofessional education (IPE) curriculum where students from different healthcare disciplines learn together to develop effective teamwork, communication, and shared decision-making skills

moral distress the emotional and psychological distress experienced when nurses are aware of the ethically right course of action but are constrained from pursuing it due to external factors or institutional limitations

Nursing Licensure Compact (NLC) an agreement among certain U.S. states and territories that allows registered nurses and licensed practical/vocational nurses to hold one multistate license, enabling them to practice in their home state as well as other participating states without needing additional licenses

nursing process a critical thinking model based on a systematic approach to patient-centered care

patient-centered care a fundamental concept in nursing that places the patient at the forefront of healthcare delivery

resource allocation the equitable and efficient distribution of healthcare resources to meet the diverse healthcare needs of patients and communities

Scope of Nursing Practice ANA resource that defines the boundaries, responsibilities, and expectations of nursing professionals in their respective roles

self-advocacy the proactive and assertive act of nurses advocating for their own well-being, professional growth, and rights within the healthcare system

simplified referral a straightforward referral process where a healthcare provider recommends or directs a patient to see another healthcare specialist or receive specific medical services; usually requires minimal administrative coordination

social determinant of health (SDOH) economic, social, and environmental factors that influence an individual's health and well-being

team members includes patients, their families, nurses, and other interdisciplinary healthcare workers involved in patient care

telehealth a method of using telecommunications technology to provide healthcare services remotely

transparent communication communication that ensures that patients have the necessary information to make autonomous decisions about their care

Assessments

Review Questions

1. One of the most important contributions that Florence Nightingale made to the development of professional nursing was _____.
   a. the implementation of strict moral codes on female nurses
   b. the use of statistical data to drive evidence-based practice
   c. the use of herbal medicine as a treatment for various illnesses
   d. the use of interprofessional teams to provide care to patients

2. What is the purpose of emphasizing DEI in nursing education?
   a. to train nurses to identify minority populations
   b. to prepare nurses for a career in public health

c. to produce culturally competent, compassionate, and equitable nurses
d. to encourage all nurses on a team to share similar thoughts, beliefs, and behaviors

3. _____ is the emotional and physical exhaustion that results from providing empathetic care to those experiencing trauma or suffering.
a. Compassion fatigue
b. Depression
c. Burnout
d. Moral distress

4. What is a fundamental idea patient-centered care?
a. Part of the nurse's role is to convince the patient to see things reasonably when it comes to making medical decisions for themselves.
b. Patients are unique individuals with their own life experiences, values, and beliefs that impact their health and healthcare decisions.
c. Concealing confusing information from the patient may be necessary to prevent them from mistakenly making the wrong decisions.
d. It is ultimately up to medical professionals to determine what treatment and care the patient must have.

5. Why does patient-centered care lead to better treatment adherence?
a. The majority of patients do not have the capacity to understand complex medical terms and decisions and instead benefit from having healthcare providers lead them in their decision-making process.
b. Patients do best when their treatment options are communicated to them in the most general, least detailed way.
c. Patients who are actively involved in their care, are able to make decisions for themselves, and have a good understanding of their conditions and treatment options are more likely to adhere to prescribed treatments and medication regimens.
d. Patients feel more secure when trusted experts are determining and driving their care.

6. Why is transparency a crucial part of patient-centered care?
a. Transparent communication ensures that patients have the necessary information to make autonomous decisions about their care.
b. Transparency allows healthcare team members to access all of the patient's medical records in order to find information that may convince the patient to make the correct decision when it comes to their treatment course.
c. Transparency enables outside parties with an interest in the patient's care to easily access the patient's personal medical information.
d. Transparency offers a way for healthcare providers to provide potentially distressing news to patients through other avenues instead of speaking directly to the patient themselves.

7. _____ is the concept that patients have the right to make decisions about their own health care.
a. Autonomy
b. Allocation
c. Self-care
d. Self-determination

8. What is one of the benefits of patient-centered care?
a. availability of generalized plans that can easily be applied to broad populations
b. greater input from ancillary staff
c. increased job satisfaction for nurses
d. an increase in the number of available specialists

9. The purpose of the ANA Standards of Practice is to:
    a. provide nurses with legal practice guidelines specific to their state.
    b. deter nurses from thinking too far "outside of the box" and keep them focused on nursing duties.
    c. offer suggestions to nurses who are uncomfortable with their role.
    d. guide nurses in delivering safe, effective, and holistic care using a systematic approach and critical thinking.

10. Why does the Scope of Nursing Practice exist?
    a. to define the boundaries, responsibilities, and expectations of nursing professionals in their respective roles
    b. to guide nurses in delivering safe, effective, and holistic care using a systematic approach and critical thinking
    c. to specify punitive measures for nurses who operate outside of their scope of practice
    d. to ensure that nurses know they are not equivalent to physicians or advanced practice providers

11. Which of the five rights of nursing delegation remind the nurse to monitor the delegate's performance of a task and to provide ongoing support, guidance, and feedback?
    a. right communication
    b. right supervision
    c. right person
    d. right circumstances

12. Why is the collaborative care approach considered especially beneficial for complex or chronic patients?
    a. It provides a comprehensive and coordinated approach to patient care.
    b. It moves these patients out of the system more quickly.
    c. It allows healthcare providers to make decisions for the patient more quickly.
    d. It allows for decision-making to help these patients live longer.

13. What is a fundamental principle of collaborative care?
    a. a lengthy referral process
    b. integrated scheduling
    c. provider-centered service
    d. comprehensive digitization of records

14. The _____ is an approach to patient care that emphasizes the importance of interdisciplinary teamwork and effective communication among healthcare professionals to provide holistic, patient-centered care.
    a. decision-making framework
    b. collaborative model
    c. integrated model
    d. simplified referral

Check Your Understanding Questions

1. Describe the different nursing roles available in telehealth.
2. Name the various ways in which Florence Nightingale contributed to the professionalization of nursing.
3. Describe the fundamental ideas of patient-centered care in nursing.
4. How does the nurse determine when it is appropriate to delegate a task?
5. How does collaborative care reduce healthcare costs?

Reflection Questions

1. Why is it important for nurses to advocate for themselves?

2. How can nurses use patient-centered care to increase disease prevention and health maintenance in communities?
3. How can nurses help increase transparency of care for their patients?
4. How does the Scope of Nursing Practice protect the public?
5. Why is delegation such a crucial nursing responsibility?
6. How does collaborative care relate to patient-centered care?

What Should the Nurse Do?

Nurse Jai faced a challenging situation during their hectic shift at a bustling urban hospital. They were responsible for two patients in adjacent rooms, each with unique needs. Patient A, Mr. Johnson, had been admitted for hypertension and was considered high risk due to a history of fainting spells. He called the nursing station complaining of dizziness and asking for assistance.

As Nurse Jai was preparing to check on him, their attention was diverted when the UAP, Lisa, urgently approached them. Lisa whispered, "Nurse Jai, I think something's wrong with Mrs. Rodriguez in the next room. She's suddenly having trouble talking, and she looks really distressed."

Now, Nurse Jai found themself in a critical decision-making moment. With two patients in immediate need, they had to weigh the urgency of the situations and determine what tasks to delegate and to whom.

1. What factors should Nurse Jai consider when deciding which tasks to delegate in this situation?
2. As Nurse Jai delegates tasks to the UAP, Lisa, what specific instructions should they provide to ensure the safety and well-being of both patients? How can they maintain open communication and collaboration with Lisa during this critical time?
3. Explain the potential consequences of delegating the wrong tasks or failing to delegate effectively in a high-stress, multitasking scenario like the one Nurse Jai is facing.
4. How does effective delegation contribute to the overall quality of patient care, and what are the potential consequences of inadequate delegation in a high-stress healthcare setting?

Competency-Based Assessments

1. Reflect on a situation during your clinical or educational experience where you needed to practice self-advocacy as a nursing student. Describe the circumstances that required you to advocate for yourself, the actions you took to address the situation, and how this experience has influenced your understanding of the importance of self-advocacy in nursing practice and education.
2. Give some specific examples of how you would apply the principles of patient-centered care in your nursing practice. Describe the potential benefits of adopting a patient-centered approach and the challenges you anticipate in implementing it. Reflect on your commitment to providing patient-centered care as a nursing student and how you plan to maintain this dedication throughout your nursing career.
3. Create a poster describing the Nursing Scope of Practice and its importance. Describe what is meant by the "who," "what," "where," "when," "why," and "how" of nursing practice, and give a visually engaging representation of each term.
4. Create a short slideshow to explain the nurse's role in providing collaborative care. Describe the specific roles nurses play in interdisciplinary collaboration and providing patient-centered care. Provide examples from clinical or educational experiences to illustrate your understanding of this crucial aspect of nursing practice.

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CHAPTER 3

Patient Communication and Interviewing

FIGURE 3.1 Communication skills are especially important in our diverse, interconnected world. (credit: modification of work "Naval Branch Health Clinic Mayport nurse midwife 211027-N-QA097-020" by U.S. Navy/Deidre Smith/Flickr, Public Domain)

CHAPTER OUTLINE

3.1 Therapeutic Communication
3.2 Comprehensive Interview Practices
3.3 Patient Education and Teaching

INTRODUCTION Communication is a fundamental part of what makes us human. Communication enables individuals to convey their ideas, thoughts, and emotions effectively. It also allows people to express themselves and to understand others better. Effective communication is essential in various aspects of life, including personal relationships, social interactions, and education. In the nursing world, effective communication is a crucial skill that will help the nurse build trust, advocate for patients, gather important information about patients, educate others, and more. Nurses benefit in understanding the meaning and types of communication to establish a therapeutic relationship with patients and encourage health promotion. Communication is foundational in health care and helps patients meet their individual healthcare goals.

3.1 Therapeutic Communication

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the process of therapeutic communication in nursing
- Identify characteristics of effective therapeutic communication
- Recognize how to evaluate therapeutic communication

Effective patient communication generates an increase in positive outcomes. These positive outcomes may include

but are not limited to improvements in a patient's compliance with medical plans, self-regulation of diet and medications, and coping mechanisms. These outcomes improve the patient's functional status after treatment.

For example, chronic diseases are especially impacted by improved patient relationships and communication with healthcare providers, due to the complex nature of chronic diseases and the need for extensive treatment. High blood pressure, or hypertension, is a chronic illness that requires scheduled follow up visits. A patient who considers themself healthy, eats a balanced diet, and works out regularly might be very disheartened with this diagnosis. This patient will need to have a solid relationship with their nurse to navigate disease management, lifestyle adjustments, and possible mental health issues they might develop from feeling like "their body betrayed them." Furthermore, this and every patient who receives a chronic diagnosis or life-altering health news depends on their nurse to serve as a healthcare guide. This role requires effective patient communication.

The specific techniques and strategies nurses use to establish a therapeutic relationship with patients and promote the patient's well-being is referred to as **therapeutic communication**. Therapeutic communication techniques used by nurses have roots going back to Florence Nightingale, who insisted on the importance of building trusting relationships with patients and believed in the therapeutic healing that resulted from nurses' presence with patients. Since then, several professional nursing associations have highlighted therapeutic communication as one of the most vital elements in nursing.

Therapeutic communication is a vital skill in nursing for multiple reasons. It can help establish a trusting patient-nurse relationship, prevent misunderstandings and errors, promote patient-centered care, improve patient satisfaction, and improve outcomes (Slade & Sergent, 2023). Nurses should understand and practice various therapeutic techniques as part of providing the best possible nursing care.

Process of Therapeutic Communication in Nursing

Establishing the therapeutic nurse-patient relationship is vital in nursing care. Nurses engage in compassionate, supportive, professional relationships with their patients as part of the art of nursing. This is especially true in psychiatric care, where the therapeutic relationship is considered the foundation of patient care and healing. The nurse-patient relationship establishes trust and rapport with a specific purpose; it facilitates therapeutic communication and engages the patient in decision-making regarding their plan of care.

Therapeutic nurse-patient relationships vary in depth, length, and focus. Brief therapeutic encounters might last only a few minutes and focus on the patient's immediate needs, current feelings, or behaviors. For example, in the emergency department setting, a nurse may therapeutically communicate with a patient in crisis who recently experienced a situational trauma. During longer periods of time, such as inpatient care, nurses work with patients in setting short-term goals and outcomes that are documented in the nursing care plan and evaluated regularly. In long-term care settings, such as residential facilities, the therapeutic nurse-patient relationship may last several months, or even years, and include frequent interactions focusing on behavior modification. Whether the relationship is brief or longer-term, each therapeutic interaction is built on the same basic framework.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Patient Communication

See the competency checklist for Patient Communication. You can find the checklists on the Student resources tab of your book page on openstax.org.

Develop Communication Goals

Developing communication goals is a crucial first step in establishing a therapeutic relationship with a patient. Part of developing communication goals is assessing the patient's communication needs. This may involve reviewing the patient's medical history, identifying any communication barriers, and assessing the patient's emotional and cognitive status.

Based on the patient's needs, specific communication goals can be established. When developing these communication goals, think of the acronym SMART. SMART stands for specific, measurable, attainable, relevant, and timely (Figure 3.2). For example, a nurse may have as a general goal to spend more time with their patients. A

SMART goal would be "I will spend an extra 15 minutes with Mrs. Cabrillo this morning and ask her three questions about her home environment in order to determine what kind of support system she has there."

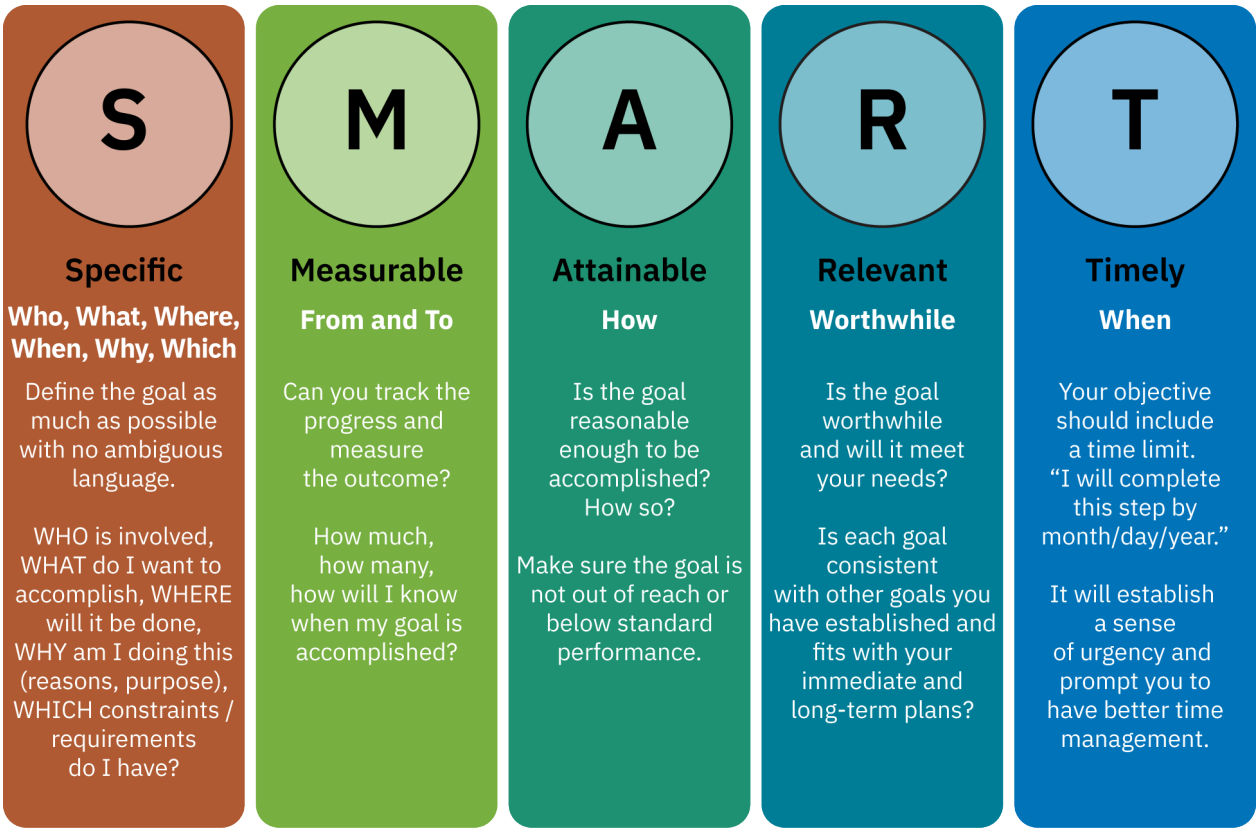

FIGURE 3.2 SMART goals offer a framework for developing patient goals that are specific, measurable, attainable, relevant, and timely. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Create the Message

Once the nurse has identified goals, they can develop a plan to achieve them. The nurse must create a message to present to the patient in a way that benefits the therapeutic communication process and the patient. The **message** is the thought or content that someone wishes to convey. This involves selecting the appropriate communication techniques based on the patient's language or other factors that may affect their ability to receive information, such as with a hearing, sensory, or vision impairment. Communication strategies may be based on the patient's cognitive abilities, educational levels, cultural preferences, or other factors. It is the responsibility of the nurse to know as much as possible about these details in advance of the interaction with the patient.

Deliver the Message

Delivering the message is a key aspect of therapeutic communication. It involves conveying information in a clear, supportive, and respectful manner, using appropriate verbal and nonverbal communication skills. The **verbal communication** involves the use of words to deliver a message. On the other hand, **nonverbal communication** refers to conveying a message without the use of words (Figure 3.3). Nonverbal communication can involve such qualities as facial expression, body language, tone of voice, and personal space.

FIGURE 3.3 Pain can be communicated through body language. (credit: "Image" by Jessica Branstetter/Flickr, CC BY 2.0)

To deliver the message effectively, nurses should use a clear tone and plain language, be mindful of the patient's body language, use the patient's preferred language so they understand, actively listen to the patient, and demonstrate patience and respect throughout the conversation. Additional considerations may be needed to reiterate and reinforce key points. Nurses should use visuals (as applicable), demonstrate empathy, encourage active two-way communication, and adapt the communication style to be culturally appropriate. When verbal communication signals match nonverbal communication signals, it can help increase the level of trust and comfort between the patient and nurse. As the nurse conducts a conversation, it is important for them to continually practice and evaluate the communication techniques being used.

Listen to the Response

Therapeutic communication is not a one-way process; delivering the message is only part of the task. The nurse must also listen to the patient, seeking feedback in the form of both verbal and nonverbal communication. This may involve asking directly for feedback from the patient or observing their nonverbal responses to different techniques used during the conversation.

Seek Clarification of the Response

The nurse should clarify any indirect, unclear, or ambiguous responses with the patient when possible. For example, a nurse may ask a patient if they eat a special diet when they are performing the admission assessment, and the patient responds "no," but their tone sounds angry and they suddenly become quiet. A question such as "I noticed that your arms are crossed and you have stopped talking; are you upset?" can help clarify nonverbal communication from the patient. Based on the feedback received, adjust the plan as needed to better meet the patient's communication needs and achieve the established goals.

Characteristics of Effective Therapeutic Communication

Effective therapeutic communication is crucial to delivering high-quality healthcare. It is a skilled approach to caring for patients that requires training and education. There are numerous strategies that can be classified as either therapeutic or nontherapeutic approaches to communication.

Therapeutic communication requires respect, trust, empathy, and a nonjudgmental culturally aware approach from the nurse. Other key characteristics of therapeutic communication include active listening, clarity and simplicity,

openness and honesty, encouragement, a supportive environment, a patient-centered approach, positive reinforcement, and appropriate use of silence. Nurses who incorporate these elements in their communication style can enhance patient outcomes and provide better quality care.

PATIENT CONVERSATIONS

A Therapeutic Conversation with a Nervous Patient

Scenario: The nurse enters the patient's room to complete their morning assessment and notices nonverbal communication from the patient.

Nurse: Good morning, Ali. How are you feeling today?

Patient: Not so good, my pain is still bothering me.

Nurse: I'm sorry to hear that. Can you tell me more about your pain?

Patient: It's a sharp pain in my lower back, and it gets worse when I try to move. It's about a 7 out of 10.

Nurse: I see. Have you been taking your pain medication that the doctor ordered?

Patient: No, I don't like the way it makes me feel.

Nurse: I understand. Can you tell me what it is that you don't like?

Patient: They make me feel dizzy and sleepy.

Nurse: Hm. Well let's see if we can try some other strategies to help manage your pain. Have you tried any relaxation techniques, like deep breathing or meditation?

Patient: No, I haven't.

Nurse: Well, those techniques can be really helpful for managing pain. I can show you some exercises that might work for you. And we can also talk to your doctor about adjusting your medication if necessary.

Patient: Okay, that sounds good.

Nurse: Great. Let's start with some breathing exercises. I'll guide you through them, and you can let me know how it feels.

Patient: Okay, thank you.

Build Trust Through Honesty

A trusting nurse-patient relationship can lead to increased adherence to the treatment plan and improved outcomes. Also, a patient who trusts their interviewer is more likely to communicate personal and private information regarding themselves and their lifestyle. The nurse can build a trusting relationship through admitting mistakes/errors, honoring patient's autonomy and choices, finding unknown answers and following up to close the loop, providing realistic expectations, building rapport, demonstrating consistent behavior, and encouraging open communication.

Another way to create a safe and trusting space for patients is by being transparent. Having **transparency** means being open and honest with the patient about their health conditions, treatment options, and potential outcomes. It also involves educating the patient on these issues and options in plain language that is readily understandable by the patient, including using a translator if necessary.

Keeping promises is another way to build trust through honesty with patients. For example, if the nurse tells the patient they will return in one hour with their pain medication, they should try their best to keep their promise to their patient in order to foster a pattern of trust.

Active Listening

Listening is obviously an important part of communication. There are three main types of listening: competitive, passive, and active. During **competitive listening** we are focused on sharing our own point of view instead of

listening to someone else. During **passive listening** we are not interested in listening to the other person and we assume we understand what the person is communicating, without verifying the other person's message. During **active listening**, we are communicating verbally and nonverbally that we are interested in what the other person is saying while also actively verifying with the speaker that we understand. For example, an active listening technique is to restate what the person said and then verify our understanding is correct. This feedback process is the main difference between passive listening and active listening.

Active listening involves fully focusing on and understanding the message being conveyed by the speaker. It requires paying close attention to both verbal and nonverbal cues, such as tone of voice, body language, and facial expressions, and responding appropriately to the speaker's message. Active listening involves withholding judgment and providing feedback, without interruption to the speaker, that shows the speaker that they have been heard and understood. This technique is important in building and maintaining effective communication and relationships, as it helps to create an environment where individuals feel heard, valued, and understood.

Nonverbal communication is an important component of active listening. SOLER is a mnemonic for establishing good nonverbal communication with patients. SOLER stands for the following:

- S: Sitting and squarely facing the patient
- O: Using open posture (such as avoiding crossing arms)
- L: Leaning toward the patient to indicate interest in listening
- E: Maintaining good eye contact
- R: Maintaining a relaxed posture

LINK TO LEARNING

This brief video shows examples of active listening (https://openstax.org/r/77ActListenVid) as well as strategies for demonstrating the skill.

Respect the Patient's Values and Beliefs

According to the American Nurses Association (ANA) Code of Ethics (2015), nurses must practice with cultural humility and inclusiveness (ANA, 2015). Cultural humility is a lifelong process where one examines their own cultural beliefs and practices as well as adopts a humble and respectful attitude while learning about individuals of other cultures. Culture is constantly changing and evolving, so true cultural competence requires a lifetime of learning and adapting to these changes. It is important for the nurse to accept their own cultural beliefs, as well as their patient's when building a trusting relationship.

There are both intrapersonal and interpersonal components to cultural humility (Hughes et al., 2020). The intrapersonal component consists of a personal awareness of one's own limited knowledge of the patient's culture. The interpersonal component involves a respect for the patient's culture and openness to their beliefs and experiences. By focusing on developing partnerships with patients, the nurse can create a space that encourages learning and appreciation for other cultures. It is a patient-centered way of providing culturally sensitive care.

Cultural Awareness

An individual's cultural background influences their beliefs, feelings, and attitudes toward health care. Their culture determines how they view health and illness, which in turn shapes how they view healthcare providers and how receptive they are to their treatment plans. Culture also determines who receives care and the quality of their care. Certain cultures experience higher rates of disease due to genetics or health disparities caused by socioeconomic factors. Various cultures have their own traditional healing practices and beliefs, and many people still use these practices, either alongside or in place of Western medicine. Nurses face patients from different cultures with their own beliefs and practices. **Cultural awareness** is the recognition of the characteristics of one's own culture and other people's, and of the differences between cultures. It is important that nurses be respectful of these individual differences in order to counteract any biases so that patients can receive the best possible care.

To ensure patients feel respected and heard, healthcare professionals should actively listen to their patients, respect cultural practices, ask open-ended questions, and use nonjudgmental language. They should also be aware

of their own biases and avoid imposing their beliefs or values on patients.

CULTURAL CONTEXT

Providing Culturally Sensitive Care

One way the nurse can show cultural sensitivity is by safely incorporating elements of the patients' culture into their care. The nurse will speak with the patient and try to identify a cultural norm that can be safely integrated into the patients' prescribed plan of care. An example of this could be in allowing the patients' newborn baby to be wrapped in a special blanket that does not have animals on it. Another example might be the nurse showing respect of the Judaism practice of waiting until the eighth day of life for circumcision to take place. This allows the patient to feel safe that their baby's soul will not be stolen by the animals. While this practice might seem confusing to the nurse, a culturally sensitive nurse will see this as an opportunity to safely incorporate the patients' belief into their care.

Show Compassion

In addition to the therapeutic techniques listed in Table 3.1, nurses should genuinely communicate with empathy. Communicating honestly, genuinely, and authentically is powerful. It opens the door to creating true connections with others. Communicating with empathy has also been described as communicating with emotion. Research has demonstrated that when healthcare teams communicate with empathy, there is improved patient healing, reduced symptoms of depression, and decreased medical errors.

Techniques	Description
Using Silence	At times, it's useful to not speak at all. Deliberate silence can give both nurses and patients an opportunity to think through and process what comes next in the conversation. It may give patients the time and space they need to broach a new topic.
Accepting	Sometimes it is important to acknowledge a patient's message and affirm that they've been heard. Acceptance isn't necessarily the same thing as agreement; it can be enough to simply make eye contact and say, "Yes, I hear what you are saying." Patients who feel their nurses are listening to them and taking them seriously are more likely to be receptive to care.
Giving Recognition	Recognition acknowledges a patient's behavior and highlights it. For example, saying something such as "I noticed you took all of your medications today" draws attention to the action and encourages it.
Offering Self	Hospital stays can be lonely and stressful at times. When nurses are present with their patients, it shows patients they value them and are willing to give them time and attention. Offering to simply sit with patients for a few minutes is a powerful way to create a caring connection.
Giving Broad Openings/ Open-Ended Questions	Therapeutic communication is often most effective when patients direct the flow of conversation and decide what to talk about. To that end, giving patients a broad opening such as "What's on your mind today?" or "What would you like to talk about?" can be a good way to allow patients an opportunity to discuss what's on their mind.
Seeking Clarification	Similar to active listening, asking patients for clarification when they say something confusing or ambiguous is important. Saying something such as "I'm not sure I understand. Can you explain it to me?" helps nurses ensure they understand what's actually being said and can help patients process their ideas more thoroughly.

TABLE 3.1 **Therapeutic Communication Techniques**

Techniques	Description
Placing the Event in Time or Sequence	Asking questions about when certain events occurred in relation to other events can help patients (and nurses) get a clearer sense of the whole picture. It forces patients to think about the sequence of events and may prompt them to remember something they otherwise wouldn't.
Making Observations	Observations about the appearance, demeanor, or behavior of patients can help draw attention to areas that may indicate a problem. Observing that they look tired may prompt patients to explain why they haven't been getting much sleep lately, or making an observation that they haven't been eating much may lead to the discovery of a new symptom.
Encouraging Descriptions of Perception	For patients experiencing sensory issues or hallucinations, it can be helpful to ask about these perceptions in an encouraging, nonjudgmental way. Phrases such as "What do you hear now?" or "What does that look like to you?" give patients a prompt to explain what they're perceiving without casting their perceptions in a negative light.
Encouraging Comparisons	Patients often draw upon previous experiences to deal with current problems. By encouraging them to make comparisons to situations they have coped with before, nurses can help patients discover solutions to their problems.
Summarizing	It is often useful to summarize what patients have said. This practice demonstrates to patients that the nurse was listening and allows the nurse to verify information. Ending a summary with a phrase such as "Does that sound correct?" gives patients explicit permission to make corrections if they're necessary. Reflecting patients often ask nurses for advice about what they should do about particular problems. Nurses can ask patients what they think they should do, which encourages patients to be accountable for their own actions and helps them come up with solutions themselves.
Focusing	Sometimes during a conversation, patients mention something particularly important. When this happens, nurses can focus on the important statement, prompting patients to discuss it further. Patients don't always have an objective perspective on what is relevant to their case, but as impartial observers, nurses can more easily pick out the topics on which to focus.
Confronting	Nurses should only apply this technique after they have established trust. In some situations, it can be vital to the care of patients to disagree with them, present them with reality, or challenge their assumptions. Confrontation, when used correctly, can help patients break destructive routines or understand the state of their current situation.
Voicing Doubt	Voicing doubt can be a gentler way to call attention to incorrect or delusional ideas and perceptions of patients. By expressing doubt, nurses can force patients to examine their assumptions.
Offering Hope and Humor	Because hospitals can be stressful places for patients, sharing hope that patients can persevere through their current situation and lightening the mood with humor can help nurses establish rapport quickly. This technique can keep patients in a more positive state of mind. However, it is important to tailor humor to the patient's sense of humor.

TABLE 3.1 Therapeutic Communication Techniques

Nontherapeutic Communication

Communication patterns or techniques that have negative effects on the development of a therapeutic relationship are referred to as **nontherapeutic communication**. It can also have negative effects on the patient's well-being.

Nontherapeutic communication can include behaviors such as interrupting the patient, giving personal opinions or advice without being asked, using judgmental or dismissive language, being insensitive to cultural or individual differences, or failing to provide adequate emotional support. These communication patterns may lead to misunderstandings, increased anxiety, decreased trust, and diminished patient satisfaction. Nurses must be aware of these types of potential barriers to communication. There are several nontherapeutic responses to avoid. Table 3.2 lists responses that often block the patient's communication of their feelings or ideas.

Response	Why It Is Nontherapeutic
Asking Personal Questions	Asking personal questions that are not relevant to the situation is not professional or appropriate. Don't ask questions just to satisfy your curiosity. For example, asking, "Why have you and Mary never married?" is not appropriate. A more therapeutic question would be, "How would you describe your relationship with Mary?"
Giving Personal Opinions	Giving personal opinions takes away the decision-making from the patient. Effective problem-solving must be accomplished by the patient, not the nurse. For example, stating, "If I were you, I'd put your father in a nursing home" is not therapeutic. Instead, it is more therapeutic to say, "Let's talk about what options are available to your father."
Changing the Subject	Changing the subject when someone is trying to communicate with you demonstrates a lack of empathy and blocks further communication. It seems to say that you don't care about what the person is sharing. For example, stating, "Let's not talk about your insurance problems; it's time for your walk now" is not therapeutic. A more therapeutic response would be, "After your walk, let's talk some more about what's going on with your insurance company."
Stating Generalizations and Stereotypes	Generalizations and stereotypes can threaten nurse-patient relationships. For example, it is not therapeutic to state the stereotype, "Older adults are often confused." It is better to focus on the patient's concern and ask, "Tell me more about your concerns about your father's confusion."
Providing False Reassurances	When a patient is seriously ill or distressed, the nurse may be tempted to offer hope with statements such as, "You'll be fine" or "Don't worry; everything will be all right." These comments tend to discourage further expressions of feelings by the patient. Here is a more therapeutic response: "It must be difficult not to know what the surgeon will find. What can I do to help?"
Showing Sympathy	Sympathy focuses on the nurse's feelings rather than the patient's. A statement like, "I'm so sorry about your amputation; I can't imagine losing a leg." shows pity rather than trying to help the patient cope with the situation. A more therapeutic response would be, "The loss of your leg is a major change; how do you think this will affect your life?"

TABLE 3.2 Nontherapeutic Responses

Response	Why It Is Nontherapeutic
Asking "Why" Questions	A nurse may be tempted to ask the patient to explain "why" they believe, feel, or act in a certain way. However, patients and family members may interpret "why" questions as accusations and become defensive. It is best to phrase a question by avoiding the word "why." For example, instead of asking, "Why are you so upset?" it is better to rephrase the statement as, "You seem upset. What's on your mind?"
Approving or Disapproving	Nurses should not impose their own attitudes, values, beliefs, and moral standards on others while in the professional nursing role. Judgmental messages contain terms such as "should," "shouldn't," "ought to," "good," "bad," "right," or "wrong." Agreeing or disagreeing sends the subtle message that nurses have the right to make value judgments about the patient's decisions. Approving implies that the behavior being praised is the only acceptable one, and disapproving implies that the patient must meet the nurse's expectations or standards. Instead, the nurse should help the patient explore their own beliefs and decisions. For example, it is nontherapeutic to state, "You shouldn't consider elective surgery; there are too many risks involved." A more therapeutic response would be, "So you are considering elective surgery. Tell me more about it." This gives the patient a chance to express their ideas or feelings without fear of being judged.

TABLE 3.2 Nontherapeutic Responses

Evaluating the Effectiveness of Therapeutic Communication

As discussed previously, therapeutic communication is defined as the specific techniques and strategies nurses use to establish a therapeutic relationship with patients and promote the patient's well-being. Therefore, the general goal of every therapeutic interaction between a nurse and patient is the mutual exchange of information that leads to a new understanding on the part of the patient. After every therapeutic communication, the nurse must evaluate the interaction for its effectiveness in order to determine if more education or assistance is needed. Sometimes, specific phrases are encouraged for use at the end of the conversation. "Is there anything else I can do for you? I have the time." is one such phrase that is encouraged. It allows the patient to ask for any additional assistance while showing that the nurse is present and available. The hope is that patients feel heard and attended to by their healthcare providers.

Reflect on Response

Nonverbal cues such as the patient's general mood can be an indicator of how they are feeling about an interaction. If the patient's body language indicates that they might be angry, scared, or upset, ask them about it. Using therapeutic techniques, talk to the patient and try to find out why they are feeling negatively about the interaction.

If the goal of the conversation has been met, seek feedback directly from the patient. Ask if the conversation was helpful for them. Specific questions to ask patients might include:

- What concerns do you have about your plan of care?
- What questions do you have about your medications?
- Did I answer your question(s) clearly or is there additional information you would like?

Listen closely for feedback from patients. Feedback provides an opportunity to improve patient understanding, improve the patient-care experience, and provide high-quality care.

Compare Response to Desired Communication Goals

The best way to determine patient understanding of the conversation is to use the **teach-back method**. In order to judge their level of understanding, have the patient re-state to you, in their own words, your original message. Then, compare the patient's understanding of the therapeutic communication with the original communication goals. Remember that a SMART goal should be set prior to a therapeutic communication in order to provide specific details to guide the interaction (Table 3.3). This goal will not always be met, even if the nurse and patient get along and communicate well. The important thing is to determine if the goal was met, and if not, what prevented it.

SMART Goal	Action/Response	Met/Not Met
The patient will notify the nurse promptly for pain intensity level that is greater than their comfort-function goal throughout shift.	The patient called for pain management for a pain level of 4/10 during the shift.	Met
The patient's blood pressure and heart rate will return to baseline levels by the end of the shift.	During last round of shift, patients' vital signs included: Heart Rate 104 B/P 114/74	Met
The patient will identify and perform preferred actions to ensure adequate sleep by discharge.	The patient verbalized techniques for healthy sleep promotion, including decreasing stimulation by turning TV off and using soft ambient lights.	Not Met- Patient identified actions to promote quality sleep but did not perform these actions. At midnight the patient had overhead room lights on, the TV was loud, and four friends were at the bedside.
The patient will demonstrate appropriate use of adaptive equipment (e.g., a walker) for safe ambulation by the end of the shift.	Patient demonstrated use of walker to ambulate to bedside chair and again when returning to bed.	Met

TABLE 3.3 SMART Goals SMART goals should be set prior to therapeutic communication in order to provide specific details to guide the nurse-patient interaction.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Using the Teach-Back Method

See the competency checklist for Using the Teach-Back Method. You can find the checklists on the Student resources tab of your book page on openstax.org.

LINK TO LEARNING

This Use the Teach-Back Method sheet (https://openstax.org/r/77TeachBackMeSh) describes how nurses can incorporate plain language, teach-back, and coaching to promote consistent use of teach-back when educating patients.

Revise Message if Communication Ineffective

If the therapeutic communication proves ineffective, the first step is to attempt to determine why. It could be due to nontherapeutic communication techniques from the nurse or an emotional response from the patient. Explore and address any communication barriers, as well as any patient concerns. If necessary, revise and redeliver the goal message.

An example of a nurse encountering a therapeutic barrier is when the nurse asks the patient about their pain control. "Are you in pain? What about when you're walking around? The medication should help you with that." The nurse asks these questions while typing on the computer and looking at the screen. The patient responds, "No it's

fine. I'll be all right." The nurse should realize that they have met a communication barrier. They asked several questions without waiting for a response; they also suggested a response for the patient, and they did not make eye contact with the patient. In order to fix this, the nurse can close the computer screen and sit at the patient's bedside; make eye contact; ask one question at a time; and wait for the patient's response before continuing. This scenario shows that sometimes it is necessary for the nurse to rephrase their questions or messages and deliver them in a different way to elicit a more detailed patient response.

3.2 Comprehensive Interview Practices

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Recall the four phases of a comprehensive interview
- Apply techniques the nurse can use during a comprehensive interview
- Recognize special considerations when conducting a comprehensive interview

A comprehensive patient interview has many purposes. It provides an opportunity for the nurse to establish a rapport with the patient and begin a therapeutic relationship. It also enables the nurse to gather detailed information about the individual patient. This includes medical history, current symptoms, and medications, as well as emotional, psychological, cultural, and social needs. This information is essential for developing an accurate nursing diagnosis, developing an appropriate care plan, and making informed decisions about patient care.

A comprehensive patient interview is crucial in nursing. It gives the nurse vital information about the patient that cannot be gathered elsewhere, such as their feelings, perceptions, beliefs, values, and other subjective personal information. This type of information is extremely important and can inform the patient's care in many ways, including how the patient processes health information, what types of treatment they will allow or not allow, and whether they will use any complimentary or alternative medicine.

Phases of a Comprehensive Interview

Performing a comprehensive nursing interview requires professional, interpersonal, and interviewing skills. Sometimes the questions that need to be asked are of a very personal nature and would seem intrusive in any other environment. However, nurses have to ask these questions and by remaining professional, they can minimize the patient's discomfort. The nurse must also have interpersonal or soft skills when interviewing the patient. Interpersonal skills help the nurse to develop a productive conversation with the patient. Soft skills include being aware of the patient's emotional status, having empathy, being a good listener, speaking positively, and many more. People who have these skills can approach anyone and start a conversation with ease. Lastly, the nurse must develop strong interviewing skills. These are skills that will allow them to steer the conversation into specific areas to reveal patient needs and to offer assistance when necessary. There are four phases to a comprehensive nursing interview: the preparatory phase, introductory phase, maintenance phase, and termination phase.

Preparatory Phase

The **preparatory phase** happens before the face-to-face meeting with the patient. Prior to conducting the interview, the nurse should ensure that the interview environment is private, quiet, and comfortable. The nurse should also schedule interviews when time is not limited or under pressure; minimize interruptions by silencing their cell phone and using other "do not disturb" strategies. This will help the patient feel more relaxed and focused during the interview. Gather any necessary equipment or supplies such as a computer for taking notes during the conversation. Review the patient's medical record for important information about the patient's medical history, current medical conditions, medications, and any recent procedures or tests that may be relevant to the interview.

Introductory Phase

During the brief **introductory phase**, patients may realize they need assistance as they adjust to their current status. Simultaneously, nurses introduce themselves and begin to obtain essential information about patients as individuals with unique needs, values, beliefs, and priorities. In addition, the nurse establishes trust and begins to develop rapport with the patient. Nurses ensure privacy when talking with the patient and providing care and respect the patient's values, beliefs, and personal boundaries.

A common framework used for introductions during patient care is AIDET, a mnemonic for Acknowledge, Introduce,

Duration, Explanation, and Thank You.

- Acknowledge: Greet the patient by the name documented in their medical record. Make eye contact, smile, and acknowledge any family or friends in the room. Ask the patient their preferred way of being addressed (for example, "Mr. Doe," "Jonathon," or "Johnny") and their preferred pronouns (e.g., he/him, she/her, they/them).
- Introduce: Introduce yourself by your name and role. For example, "I'm Marie, and I am a nursing student working with your nurse to take care of you today."
- Duration: Estimate a timeline for how long it will take to complete the task you are doing. For example, "I am here to perform an admission assessment. This should take about 15 minutes."
- Explanation: Explain step by step what to expect next. For example, "I will be putting this blood pressure cuff on your arm and inflating it. It will feel as if it is squeezing your arm for a few moments." Answer any questions the patient may have.
- Thank You: At the end of the encounter, thank the patient and ask if they need anything before you leave. In an acute or long-term care setting, ensure the call light is within reach and the patient knows how to use it. If family members are present, thank them for being there to support the patient, as appropriate. For example, "Thank you for taking time to talk with me today. Is there anything I can get for you before I leave the room? Here is the call light [place within reach]. Press the red button if you would like to call the nurse."

LINK TO LEARNING

Watch this brief video demonstrating use of the AIDET tool (https://openstax.org/r/77AIDETUseVideo) to learn more.

Maintenance Phase

The majority of a nurse's time with a patient is in the **maintenance phase**. During this phase, nurses use active listening. The nurse begins by asking the reason the patient is seeking care; the answer helps to reveal what is important to the patient. The nurse then uses assessment findings to develop a nursing plan of care and plan education for the patient. If a care plan has already been established on admission, nurses use this time to implement interventions targeted to meet short-term outcomes and long-term goals. During the maintenance phase, patients begin to accept nurses as health educators, counselors, and care providers. Nurses use therapeutic communication techniques to facilitate patients' awareness of their thoughts and feelings and mutually develop goals and an individualized plan of care. Nurses provide reflective and nonjudgmental feedback to patients to help them clarify their thoughts, goals, and coping strategies.

Termination Phase

The final phase of a nurse-patient relationship is the **termination phase**. This phase typically occurs at the end of a shift or upon discharge from care. If the previous working phase has been successful, the patient's needs have been successfully met by collaboration among the patient, nurses, and other members of the interprofessional healthcare team. The nurse should be aware the patient may try to return to the working phase to avoid termination of the relationship. During the termination phase, the nurse can encourage the patient to reflect on progress they have made and review post-discharge goals. The nurse also makes community referrals for follow-up and continuation of support in meeting goals.

Techniques Used in Effective Interviewing

Techniques used in effective patient interviewing reflect techniques used in therapeutic communication. Empathy, a nonjudgmental attitude, and cultural sensitivity remain important methods of putting patients at ease and establishing trust between nurse and patient. Effective interviewing techniques are therapeutic communication methods that have been made slightly more specific in order to elicit responses from the patient while keeping the interview patient-centered. When preparing for an effective interview, the nurse should refresh themselves on the specific techniques that are helpful in the particular situation.

Ask Open-Ended Questions

An interviewing technique called **open-ended questioning** requires the interviewer to ask questions that prompt detailed answers from the interviewee. Unlike closed-ended questions, which lead to simple yes-or-no responses,

open-ended questions encourage the interviewee to speak more freely and provide more comprehensive information. For example, the open-ended question "tell me about your pain" will elicit a more detailed response than the close-ended question "are you in pain?" which warrants a yes or no response.

Open-ended questions can help build rapport between the interviewer and interviewee by allowing the interviewee to share their thoughts and experiences. This technique also encourages reflective thinking, leading to more thoughtful and insightful responses. Furthermore, open-ended questions can explore unexpected areas, uncovering valuable information that may have been missed with closed-ended questions.

When using open-ended questioning as an interviewing technique, it is essential to structure questions carefully to avoid leading the interviewee in a particular direction. The interviewer should remain neutral and nonjudgmental in their responses and actively listen to the interviewee's answers, following up on any interesting points to ensure that all valuable information is captured.

Adaptive Questioning

Also referred to as guided questioning, **adaptive questioning** is a form of open-ended questioning that helps to encourage a patient to fully communicate without interrupting the flow of their narrative. The questions and follow-up questions are adjusted based on the patient's previous answers. Start with general questions, making them more specific as you move through the interview. A series of questions, asked one at a time, often helps patients open up, as does offering multiple choices for answers. Request additional information when necessary by asking the patient to clarify their statements. The following is an example that shows how adaptive questioning works. Imagine yourself interviewing an older female patient who is at the primary care provider's office because of hypertension complications. She mentions casually to you, "Today is the six-month anniversary of my husband's death." Failure to follow up with adaptive questions such as "How does this make you feel?" may result in the loss of important data that could provide clues to the patient's current state of health.

Encourage the Patient to Verbalize Feelings

Encouraging patients to verbalize their feelings is a highly effective technique in the interview process. Not only does it help clarify communication with their nurse, it helps the patient gain insight and understanding into their own emotions, which is a powerful healing tool.

Verbalizing feelings can help patients to build trust and establish a therapeutic relationship with their nurse. When patients feel that they are being listened to and understood, they are more likely to feel comfortable sharing their thoughts and feelings. This can create a safe and supportive environment in which patients feel able to explore their emotions and work toward positive change.

Additionally, expressing feelings can help patients to gain insight into their own emotions and thoughts. When patients put their feelings into words, it can help them to identify and understand the root causes of their problems, and this can be a crucial first step in the healing process. Verbalizing feelings can also help patients to make sense of their experiences and feel more in control of their lives.

Verbalizing feelings can help patients to release pent-up emotions and reduce stress. Often, when patients keep their feelings bottled up inside, it can lead to emotional distress and physical symptoms such as headaches, stomach problems, and sleep disturbances. Verbalizing feelings can help patients release these emotions and feel a sense of relief and catharsis.

Provide Empathy and Validation

Empathy is key in nursing health assessments, as it demonstrates that the nurse understands and cares about what a patient is experiencing and helps establish a trusting nurse–patient relationship. Empathic responses during a comprehensive assessment interview can be both verbal ("I understand") and nonverbal (offering a tissue if the patient is crying). Beyond being empathic, the nurse should be sure to **validate** a patient's feelings to help reassure them that their emotions are natural and reasonable and their problems are understood and will be fully addressed. This offers a reassuring environment in which patients are free to express their feelings. An example might be with a patient who has a history of claustrophobia but needs to have an MRI. The patient tearfully tells the nurse that they know their fear is not rational and they will be supervised during the test, but they can't help but feel scared. A nurse who seeks to validate the patient's feelings will offer them reassurances that their feelings and emotions are natural and understood by the staff involved, and their concerns will be addressed before proceeding with the test.

Respect the Patient's Values and Beliefs

Respecting the patient's values and beliefs is an essential aspect of therapeutic communication. It involves acknowledging and validating the patient's cultural, spiritual, and personal beliefs and values and incorporating them into the therapeutic process.

When communicating with patients, nurses should be sensitive to cultural differences, religious beliefs, and personal preferences that may influence the patient's decisions about their health. For example, some patients may have specific dietary restrictions or may prefer certain treatments based on their cultural or religious beliefs. Others may have different beliefs than their healthcare provider has about the causes and treatments of their illness.

CULTURAL CONTEXT

Respecting Cultural Differences

We live in an increasingly multicultural society. An individual's culture has an enormous impact on their beliefs, feelings, and attitudes toward health care. As a nurse, you will encounter diverse patients who have different cultural beliefs regarding their health or treatment, or perhaps beliefs that you do not agree with or find confusing. For example, a Chinese patient may rely on acupuncture and herbs for their care, even for serious illness. A Filipino family may request that the family be informed of a poor prognosis before the patient, so that the family can decide what is appropriate for the patient to know. In these cases, it is the nurse's role to approach the relationship with empathy, cultural humility, and cultural acceptance.

Special Considerations During the Comprehensive Interview

There are three variations in communication that carry special considerations during the comprehensive interview. Differences in age, culture, and emotion all have special importance that the nurse must be aware of and address during the comprehensive interview. What is appropriate behavior for a child might be inappropriate for a teenager or an older adult. The nurse might enter into the interview with minimal information, but based on the patient's behavior (appropriate or inappropriate), they may have to make adjustments to connect with the patient. An example of this is when a nurse attempts to administer a vaccine to a 16-year-old boy. The patient backs away, climbs onto his mothers' lap and hides his face into her neck. This behavior should tell the nurse that the patient might be 16 years old but is displaying behavior indicative of a young child. The nurse will have to alter their approach and communication to meet the patient at the developmental level of a young child.

Age Considerations

Age is an important factor to consider during a comprehensive nursing interview, as patients' healthcare needs and concerns can differ based on their age. As such, nurses need to consider age in various aspects, such as developmental stage, health history, lifestyle, and communication style.

When interviewing children, it is important to use age-appropriate language and communication techniques. An example is by engaging the child in play during the interview, this can decrease the child's anxiety, provide distraction from the medical evaluation, and allow the nurse to assess developmental milestones. Use simple words and avoid medical jargon. Establish rapport with the child and allow them to express their concerns and needs. Involve the parent or guardian in the interview process and be mindful of any cultural or religious considerations.

Adolescents may have unique health concerns related to puberty, sexuality, and mental health. It is important to use age-appropriate language and respect their privacy and confidentiality. Consider involving them in their care decisions. Establish trust and a nonjudgmental attitude to encourage open communication.

Adults may have different health concerns based on their age, gender, and lifestyle factors. Young adults might be more concerned with career goals and reproductive health versus middle-aged adult whom acknowledge responsibility and family roles, might inquire about work-related stress and want to discuss preventative measures. Consider the patient's cultural background, occupation, educational level, health status, and family history when conducting the interview. Use open-ended questions to encourage the patient to express their concerns and provide sufficient time for the patient to answer. Teach-back, as always, is the best way of evaluating the effectiveness of the education provided.

Older adults may have unique health concerns related to chronic diseases, functional decline, and cognitive impairment. Use clear and simple language and allow sufficient time for the patient to answer. Be mindful of sensory and mobility impairments, and adjust the interview techniques accordingly. Involve family members or caregivers as needed to provide support and help with communication.

LIFE-STAGE CONTEXT

Hearing Impairment in Older Adults

The ability to hear often decreases with age. Hearing deficiencies can be mistaken for confusion or cognitive slowing in older patients. Older patients should be screened for hearing loss regularly. When performing an interview with an older adult with hearing loss, the nurse should sit directly in front of the patient, speak clearly and at a normal pace, and avoid covering their face with their hands. Be prepared to be patient and repeat questions or statements frequently.

Cultural Considerations

Culture is a central consideration during a comprehensive nursing interview, as it can affect a patient's health beliefs, values, and practices. Cultural factors include ethnicity, religion, language, socioeconomic status, and geographic location. Nurses need to be aware of these factors to ensure effective communication with patients from diverse cultural backgrounds.

Language barriers may make effective communication difficult; therefore, professional interpreters or language translation services should be used. Printed materials should be provided in the preferred language whenever possible.

Cultural beliefs and values regarding health and illness may vary across different cultures, and nurses should be sensitive to these differences and adapt their care accordingly.

Patients from low-income or marginalized communities may have low health literacy and understanding of health information. Nurses should use plain language and avoid medical jargon to ensure that patients understand their diagnosis, treatment plan, and medication regimen. Patients from collectivist cultures may rely heavily on family or community support when making health-related decisions. In these cases, nurses should involve family members or caregivers in the care process and respect their input.

Nurses should be aware of their own cultural biases and stereotypes that may impact their care of patients from diverse cultural backgrounds. (This should include awareness about biases, assumptions, or stereotypes about people from the nurse's own cultural background.) It is important to approach each patient as an individual with unique needs and beliefs. By considering these cultural factors, nurses can provide patient-centered care, promote effective communication, and improve health outcomes.

UNFOLDING CASE STUDY

Unfolding Case Study #1: Part 1

The nurse is conducting the initial assessment on a 28-year-old female who presents to the family walk-in clinic. The female patient is accompanied by her 10-year-old son.

Past Medical History	Patient is a mother of one, who cares for her child and older mother in a small apartment. The mother is homebound and is not present at appointment. Patient cleans houses to support her family, but income is inconsistent. Patient has an eighth-grade education and speaks no English. Medical history includes seasonal allergies, sinusitis, and two episodes of COVID-19 in the past two years. **Family history:** Patient's father is deceased and patient's mother has Alzheimer's disease, stage II. Patient's son is in good health, talkative, and attentive to his mother. **Social history**: Patient is primary caregiver for older mother and adolescent. No other support systems available. Patient has difficulty shopping and making doctor's appointments due to lack of care for older mother. Patient has difficulty communicating in English, but son translates for his mother. **No current medications and no known allergies.**
Nursing Notes	**1630: Triage Assessment** Patient responds to gestures but speaks little English. Son provides translation for his Spanish-speaking mother. Patient reports frequent coughing episodes with production of large amounts of yellow sputum which are exacerbated with activity. Patient is alert and cooperative, but son reports frequent recent periods of lethargy, sleepiness, and states "Momma feels hot and sweaty." Patient holds the side of her head in her hands and son states that she has been complaining of an earache for three days.
Flow Chart	**1630: Triage Assessment** Blood pressure: 142/88 mmHg Heart rate: 100 beats/minute Respiratory rate: 24 breaths/minute Temperature: 101.1°F (37.2°C) Oxygen saturation: 95% on room air Pain: 8/10 - ear
Lab Results	CBC - (Abnormal) WBC 17,000 WBCs per microliter (4.5 to 11.0 × 10^9/L). Rapid Strep Test - negative Rapid COVID Test - negative

1. Recognize cues: Which findings from the information provided are most relevant? Which are the highest priority?
2. Analyze cues: Based on the current history and findings, what additional information should be obtained from the patient at this time?

Emotional Considerations

Nurses often encounter patients as they are undergoing stressful, frightening, or confusing situations. During a comprehensive nursing interview, emotions are an important factor to consider as they can have a significant impact on a patient's ability to communicate their health concerns, willingness to follow a treatment plan, and overall health outcomes. Because of this, nurses need to be equipped to effectively handle patients who may be experiencing strong emotions.

As a nurse, you will encounter patients and family members who are experiencing strong emotions, including anger. When dealing with an angry patient, your first step is always to make sure that the patient and others are safe. After that, assure the individual that you are there to help. Using therapeutic communication techniques, encourage them to express their feelings and tell you why they are angry. Often, anger is the result of fear or frustration. Allowing the patient to express their emotions in a judgment-free environment creates a trusting relationship between the patient and nurse, allowing the patient's anger to be addressed.

To provide effective care for patients experiencing strong emotions, nurses should begin by actively listening and providing emotional support by empathizing with patients' experiences and validating their feelings. It is important to adopt a nonjudgmental attitude to create a safe and supportive environment for patients to share their emotions. Cultural differences may play a role in how patients express their emotions, so nurses should be aware of these differences and adjust their communication style accordingly. For example, some cultures may view expressing emotions as a sign of weakness, while others may be more expressive. For many, a simple "tell me what happened," or asking "how can we resolve this" can cut through anger, fear, or other strong emotions and lead to a resolution. There are many factors the nurse can use to diffuse a situation. These factors include to remember the importance of ensuring safety, reducing triggers, creating a secured environment, building rapport and trust, avoiding re-traumatization, demonstrating flexibility and patience, and focusing on the patient's strength and resilience.

For patients who have experienced trauma, it is important to provide **trauma-informed care**, which considers the impact of trauma on an individual's physical, emotional, and mental well-being, by creating a safe environment and avoiding triggering language or actions. Nurses should also make appropriate referrals to healthcare professionals, such as psychologists, social workers, or psychiatrists, if a patient is experiencing significant emotional distress or mental health concerns.

3.3 Patient Education and Teaching

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Explain the purpose of patient education and teaching
- Describe factors affecting patient learning
- Define the nurse's role in patient education and teaching

Providing education is a central role for nurses and a basic part of patient care. Patient education involves providing patients, families, and communities with the necessary knowledge and skills to manage their health and prevent disease. This role involves assessing the patient's learning needs, developing customized educational plans, providing education through different methods, evaluating the effectiveness of the teaching, promoting self-care, and advocating for patients.

By fulfilling their role as educators, nurses enable patients to become active participants in their health care, leading to better health outcomes and an improved quality of life. By assessing the patient's readiness to learn, providing them with individualized education, and evaluating their understanding, nurses ensure that patients have the knowledge and skills needed to manage their health and prevent complications. In addition, nurses advocate for their patients to have access to the resources necessary to maintain their health, such as education materials, support groups, and community services.

Purpose of Patient Education and Teaching

Patient education is a vital aspect of nursing that involves providing patients with information and knowledge about their health conditions, treatment options, and self-care strategies. It plays a crucial role in improving patients' health outcomes, communication, satisfaction, cost-effectiveness, and empowerment.

The most successful education happens when patients are engaged with their health care. Research shows that when patients are educated and engaged with their care, there are significant improvements in health outcomes, patient safety, and healthcare quality (Slade & Sergent, 2023). Moreover, patient engagement also leads to lower healthcare costs. Effective patient education helps patients to understand their health conditions, treatment options, and necessary lifestyle changes. This understanding encourages them to comply with their treatment plans and make healthy decisions, reducing the risk of complications.

Patient education empowers patients by giving them the knowledge and skills to manage their health conditions, improving their confidence and self-esteem. In turn, patient education can also save healthcare systems and patients money by reducing the need for costly hospitalizations and emergency room visits. Patient education is essential in nursing and must be carried out with diligence to ensure that patients receive accurate and relevant information.

Promoting Positive Patient Outcomes

The main goal of patient education is to provide patients with the knowledge and skills they need to manage their health effectively, improve their quality of life, and achieve the best possible outcomes. Promoting positive patient outcomes is the primary goal of patient education because it helps patients to take an active role in their health care and make informed decisions and choices about their treatment options. Patient education empowers patients with the knowledge they need to manage their health and well-being, which can result in better treatment adherence, improved disease management, and better health outcomes overall.

For example, when patients understand the importance of taking their medications as prescribed, they are more likely to follow their treatment plan consistently, which can help to control their condition, prevent complications, and improve their overall health status. Similarly, when patients are educated about healthy lifestyle choices, such as proper nutrition, regular exercise, and stress management, they are better equipped to manage chronic conditions like diabetes, hypertension, and heart disease.

PATIENT CONVERSATIONS

Providing Patient Education

Scenario: The nurse is caring for a 14-year-old patient who is prescribed antibiotics for a sinus infection. The nurse is providing education on the need to complete all the medication even when the symptoms improve. The nurse wants to reinforce the education and tailor the conversation to this specific patient.

Nurse: What are your favorite movies?

Patient: I like horror movies.

Nurse: Do you ever watch zombie movies?

Patient: Yeah, I like zombies! Sometimes I dress up like zombies with my friends.

Nurse: Well, bacteria are like zombies; you have to take all the medication the way it's prescribed or else the bacteria zombies will keep coming back.

Patient: I got to really kill it dead, huh?

Nurse. That is exactly right. So remind me how you're going to do that?

Patient: I'm going to take all of the medication until it's gone, even when I start to feel better.

In addition to promoting positive patient outcomes, patient education can also help to reduce healthcare costs by minimizing hospitalizations, emergency room visits, and other costly interventions. Educated patients are better equipped to manage their conditions at home, reducing the need for medical intervention and associated costs.

The nurse should be sure to communicate important education topics to the patient using methods that are engaging and appropriate and also be sure to evaluate for effective learning.

UNFOLDING CASE STUDY

Unfolding Case Study #1: Part 2

Refer back to Unfolding Case Study #1: Part 1 to review the patient data.

Nursing Notes	**1700: Intervention** Patient appears to be in distress from frequent coughing fits with expectoration of yellow sputum. Patient is tearful and begins to cry. Son attempts to console patient. Interpreter has been called and will arrive when current assignment is complete. Nurse utilizes a picture board to assist with communication with patient. Oxygen at 2L per nasal cannula applied and warm cloth given to wipe her face. Patient is instructed by nurse to take slow, deep breaths and to sit in an upright position to improve breathing.
Provider's Orders	Chest x-ray Close observation

3. Prioritize hypotheses: Based on cues from the patient's history and assessment, the nurse determines the patient has symptoms that could indicate pneumonia. Indicate what findings are most consistent with a diagnosis of pneumonia: cough, earache, heart rate of 100 bpm, lethargy, fever, negative COVID-19 test, BP 142/88 mm Hg, WBC count 17,000.
4. Generate solutions: Based on the information provided, what actions should the nurse take next?

Promoting Health Literacy

One of the most important goals of patient education is to promote **health literacy**, which is an individual's ability to obtain, understand, and apply basic health information and services to make informed decisions about their health. There are several strategies for this, beginning with clear communication between the patient and nurse. The nurse should also assess the patient's health literacy to be able to provide education at an education level that is appropriate for the patient; as well as providing written materials that are written at an appropriate reading level and font size, and are user-friendly. Nurses should use plain and clear language when communicating with patients, avoiding medical jargon or technical terms. They should also check for understanding by asking patients to repeat instructions or explain concepts in their own words. Visual aids such as pictures, diagrams, or videos can be useful in explaining complex concepts or procedures. They can also help patients who have difficulty reading or understanding written materials.

Nurses should involve patients in the education process by asking about their concerns, preferences, and goals. They should also encourage patients to ask questions and provide feedback. They should also be sensitive to patients' cultural backgrounds and beliefs when providing education. Nurses should tailor their approach to the patient's cultural norms and values and be mindful of any potential language barriers. For example, just because a patient speaks English well does not mean that it is their language of preference while in a medical setting. The nurse must clarify along with the initial assessment with the patient what their preferred first language is and provide an interpreter when required. The nurse may also provide written educational materials in both languages.

Nurses also play a role in teaching patients how to find their own information on different healthcare issues. Technology can be a valuable tool in promoting health literacy: for example, nurses can use electronic health records or patient portals to provide information and resources. Nurses can also recommend trustworthy online resources for patients to access health information. By providing patients with the knowledge and skills they need to manage their health conditions, nurses can empower patients to take an active role in their healthcare decisions.

UNFOLDING CASE STUDY

Unfolding Case Study #1: Part 3

Refer back to Unfolding Case Study #1: Part 1 and Unfolding Case Study #1: Part 2 to review the patient data.

Nursing Notes	**1700: Assessment** **Physical examination:** Patient appears disheveled with clothes inappropriate for the cold weather, including short-sleeve shirt and shorts. While waiting for the interpreter, patient appears agitated with frequent coughing episodes. Begins to pace the room as son attempts to console her. **HEENT:** Pupils equal, reactive to light and accommodating (PERRLA), mucus membranes moist and intact, pharynx without lesions, palate intact. No thyroid enlargement noted. **Lymphatic:** Tonsillar and cervical lymph nodes slightly enlarged. Hard, palpable left axillary lymph nodes, tender to touch. No enlargement of right axillary or inguinal nodes, no pain or tenderness noted. **Respiratory:** Rales and rhonchi auscultated bilaterally. No stridor or murmur present. **Cardiovascular:** Sinus tachycardia on monitor, no edema, peripheral pulses 2+. **Abdomen:** Bowel sounds present in all 4 quadrants, no tenderness present. **Musculoskeletal:** Full ROM, no issues noted. **Skin:** Pale and dry, no bruising. **Mental assessment:** Patient reports (per son) that she is stressed from coughing and anxious about her older mother left alone at home. Patient requests that nurse "hurry and give me some medicine so I can go home." Interpreter arrived to room at 2030.
Flow Chart	**2000: Assessment** Blood pressure: 148/87 mmHg Heart rate: 110 beats/minute Respiratory rate: 26 breaths/minute Temperature: 102.2°F (37.3°C) Oxygen saturation: 97% on 2L NC Pain: 8/10 (ear)
Provider's Orders	Sputum sample Wean from oxygen before discharge home Medications: • Acetaminophen 1000 mg PO Q6 PRN • Amoxicillin 500mg PO twice daily for 10 days

5. Take action: Based on the information provided and provider orders, what interventions should the nurse implement for the patient?
6. Evaluate outcomes: After providing information to the patient about the prescribed medications, how would the nurse evaluate the patient's understanding?

Promoting Self-Care

Nurses have a central role in promoting self-care of patients through education. They teach patients about proper nutrition, exercise, and sleep habits as part of an important self-care plan. They can also teach patients how to manage chronic conditions such as diabetes or hypertension through self-care practices. Nurses can provide guidance on medication management and encourage self-monitoring of factors such as weight, blood pressure, and blood sugar levels. This can help patients identify any changes in their health and take action to prevent complications.

In addition to disease management, nurses have other ways of promoting self-care. Nurses can teach patients techniques to manage stress, such as deep breathing, mindfulness, and exercise. These techniques can help patients reduce stress levels and improve their overall well-being. Nurses can provide emotional support to patients, including active listening, empathy, and validation. This can help patients cope with emotional distress and

promote mental health.

Nurses can help patients develop self-care plans that are tailored to their individual needs and abilities. By promoting patient self-care, nurses can empower patients to take control of their health, manage their chronic conditions, and prevent complications. Overall, the nurse's role in promoting self-care as part of nursing education is critical to helping patients and communities achieve and maintain good health.

Factors Affecting Patient Learning

When providing education to patients, nurses must be aware of the multitude and complexity of factors that play a role in how each individual acquires knowledge and skills. As discussed in 3.2 Comprehensive Interview Practices, a trusting nurse-patient relationship and effective patient interview can help the nurse determine the patient's learning needs and the most effective ways with which to communicate with the patient and provide appropriate education.

Patient Learning Needs

The nurse must determine the needs of the individual patient. This includes both the goal of the education to be presented as well as the various factors that affect a patient's learning needs. At the beginning of the session, nurses can outline their goals and ask the patient about any specific goals or needs that they might have. Ask the patient for their education preferences; how would they like to be taught; do they prefer videos, brochures, or a website for reinforcement? Patient participation in how the learning session is structured and incorporating their unique preferences can improve their engagement, understanding, and satisfaction.

Patient Age and Developmental Level

A patient's age and developmental level will have a significant impact on their learning needs. Here are some ways in which age and developmental level can affect patient learning:

- Children: Younger patients have different learning needs compared to adults. Children require simpler and more concrete explanations and visuals to understand complex medical information. They may also need more repetition and reinforcement of information. Depending on their developmental level, they may also require special attention to emotional and psychological support during their treatment.
- Adolescents: Adolescents require information that is relevant to their age group, such as information about sexual health, relationships, and peer pressure. They may also require a different approach to communication and education, such as interactive and engaging programs that appeal to their interests.
- Adults: Adults have different learning needs depending on their age and developmental level. Younger adults may be more likely to prefer to have greater access to health information through the internet, mobile apps, and social media. They may seek personalized health resources, online support communities, and virtual healthcare options. And while older adults are becoming more tech-savvy as well, they may require additional support in navigating health-related websites or mobile apps. Printed materials, face-to-face interactions, and assistance from healthcare professionals or family members play a crucial role in meeting their learning needs.
- Older adults over age 65: Older patients may require special attention to their cognitive, physical, and emotional needs. They may require more time and patience to learn and understand new information, particularly if they have cognitive impairments such as dementia or Alzheimer's disease.

Choosing Effective Educational Materials

When choosing educational materials for a patient, it is important to consider the patient's individual needs and preferences. Here are some factors to consider when selecting educational materials:

- Learning preference: Patients may prefer to learn information through a variety of avenues. They may want to see it, hear it, watch a video, practice doing it, or even to watch someone perform the action in front of them. The nurse should present information in the patient's preferred learning styles. When possible, have the patient do a return demonstration of the skill being taught; ask them to explain why a procedure is important to you or have them navigate to a website that provides additional information. The more learning styles a nurse can incorporate in a teaching session, the more opportunities the patient will have to understand the information. Additionally, repetition is key to comprehension and learning.
- Literacy level: Choose materials that are written at an appropriate reading level for the patient. Use plain

language and avoid medical jargon and technical terms that may be difficult for the patient to understand.
- Cultural background: Consider the patient's cultural background and language preferences when selecting materials. Choose materials that are culturally appropriate and available in the patient's preferred language, if possible.
- Health literacy: Choose materials that are designed for patients with low health literacy, such as simple illustrations, short sentences, and bullet points. Use teach-back or show-me techniques to assess the patient's understanding and reinforce key concepts.
- Accessibility: Choose materials that are accessible to the patient, such as large print, audio, or electronic formats.
- Relevance: Choose materials that are relevant to the patient's specific health condition and needs. Use examples and case studies that are relatable to the patient's situation.
- Quality: Choose materials that are evidence-based, accurate, and written within the last 10 years. For instance, look for materials developed by reliable healthcare organizations, medical associations, government agencies, or academic institutions by searching in academic databases or Google Scholar.
- Avoid materials that are biased, outdated, or misleading. A website with a ".org" domain does not mean the information is reliable or credible.

By taking these factors into consideration, nurses can choose educational materials that are appropriate and effective for their patients. It is also important to provide patients with ongoing support and follow-up to reinforce key concepts and address any questions or concerns they may have.

Patient Learning Readiness

Prior to beginning any educational intervention, the nurse should assess the patient's physical and emotional state. Patients who are in pain, distressed, or anxious may not be ready to learn. The nurse should also determine the patient's motivation and interest in learning. Patients who are motivated to learn may be more receptive to educational interventions. The nurse can observe the patient's behavior and level of engagement during the educational intervention. Ask questions and use teach-back techniques to assess the patient's understanding of the material. Follow up with the patient after the educational intervention to reinforce key concepts and address any questions or concerns they may have.

Nurse's Role in Patient Education and Teaching

Patient education is an essential nursing responsibility. Like a teacher, the nurse is responsible for considering all aspects of the teaching and learning process. There are different strategies, goals, teaching methods and ways to learn. Nurses should employ all available strategies and constantly evaluate the effectiveness of their instruction. Lastly, nurses should document what was taught, how, and when, and record patient response along with any follow up needed.

Effective Teaching Strategies

Benjamin Bloom was a psychologist who first published his taxonomy in 1956 (Krathwohl, 2002). The basis of **Bloom's Taxonomy** is that it consists of different levels of learning, arranged according to complexity. In the original Bloom's Taxonomy, the learner needed to master the skills at the lower levels of learning before moving on to the higher levels. The taxonomy consists of three domains: cognitive, affective, and psychomotor.

In 2001, Bloom's Taxonomy was revised due to several limitations in the original framework. The original taxonomy focused predominantly on knowledge acquisition and recall, with less emphasis on higher-order thinking skills. It also failed to address the concepts of critical thinking, creativity, analysis, evaluation, and synthesis. Its hierarchical structure oversimplified the complex nature of learning by suggesting a linear process is necessary to reach the higher levels. Also, the original taxonomy primarily addressed cognitive skills and overlooked the other domains, affective and psychomotor. To address these shortcomings, the taxonomy was revised to include a broader range of cognitive processes, emphasize higher-order thinking skills, and provide a flexible framework applicable to the affective and psychomotor domains. The revision aimed to better reflect contemporary educational practices and support critical thinking and problem-solving.

Bloom's Taxonomy (Figure 3.4) offers a framework for nurses who are preparing education for patients. It details the process of learning, which helps the nurse to identify the key learning goals they want to achieve during each patient interaction. Effective teaching strategies consider all three of the learning domains. Bloom's Taxonomy also helps

the nurse as teacher understand the learning process. Nurses should use a variety of teaching methods that cater to different learning styles and provide feedback and support to help students develop their skills and knowledge in all three domains.

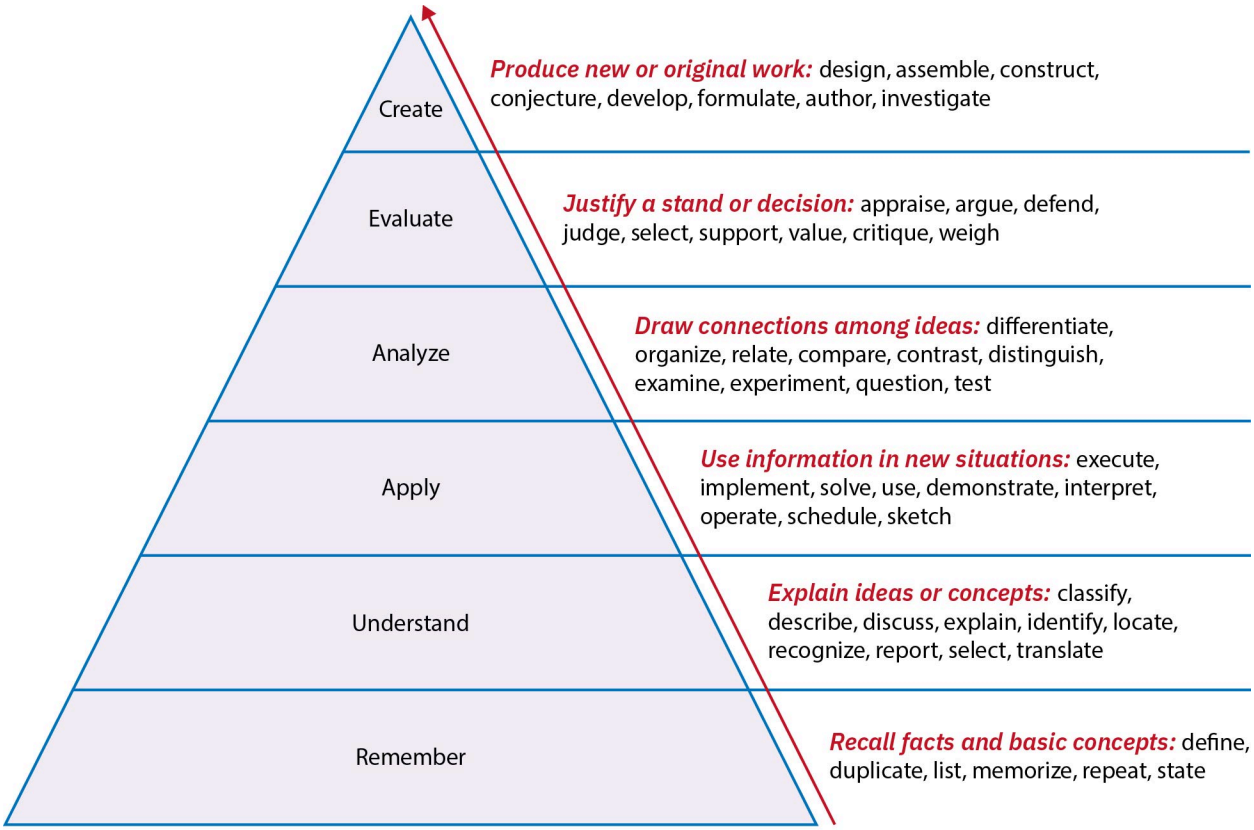

FIGURE 3.4 The revised Bloom's Taxonomy provides a framework for nurses to create effective teaching strategies based on individual patients' needs and abilities. (credit: modification of work "Bloom's Taxonomy" by Vandy CFT, CC BY 2.0)

Cognitive Domain

The **cognitive learning domain** involves intellectual skills: the understanding and development of information through application, moving up the taxonomy from basic recall to complex evaluation and creation. The cognitive domain is also concerned with mental processes such as thinking, memory, perception, and problem-solving.

At the most basic levels, cognitive learning involves acquiring, remembering, and understanding knowledge. Higher levels of cognitive learning involve the application, analysis, and evaluation of acquired knowledge, culminating in the creation of new knowledge. Effective teaching strategies for cognitive learning include lectures, discussions, demonstrations, and simulations that provide opportunities for students to process and apply new information.

It is important to note that the cognitive domain is not the only domain that is important for learning. Nurses should also consider the affective and psychomotor domains, as well as the individual needs and preferences of their patients when designing and implementing effective teaching strategies.

Affective Domain

The **affective learning domain** involves our attitudes, values, and emotions toward learning and how they develop (CDC, n.d.). Table 3.4 describes the five levels of affective learning processes in Bloom's Taxonomy. It begins with the lowest level, receiving, and describes examples of patient behaviors at each of the five levels.

Level	Description	Examples of Patient Behaviors
Receiving	Learners are open and receptive to information, ideas, or experiences	They listen respectfully and attentively to others, actively receives information, and shows openness to learning.
Responding	Learners actively participate and respond to the stimuli they have received. They demonstrate a willingness to engage and show interest in the information or experience.	A patient participates actively in their treatment plan by asking questions about treatments, tests, or options in order to fully understand them. They express their concerns, ask questions, and provide feedback about their progress and comfort level.
Valuing	Learners attach personal significance and value to the information or experience. They recognize the relevance and importance of the subject matter to their own values, beliefs, and goals.	As the patient receives care and interacts with the healthcare team, they start recognizing the importance of self-care and health promotion. They value the impact of healthy lifestyle choices on their well-being and develop an appreciation for the healthcare providers' expertise and support.
Organizing	Learners begin to organize and prioritize their values, beliefs, and attitudes. They integrate new information or experiences into their existing value system and develop a coherent set of values.	The patient begins organizing their values and beliefs related to their health. They prioritize certain aspects of their care, such as adhering to medication schedules, incorporating exercise into their routine, or making dietary changes. They resolve conflicts between their previous habits and the new behaviors recommended for their well-being.
Characterizing by Value or Internalizing	Learners internalize the values and demonstrate them consistently in their behavior. They act in accordance with their values and beliefs, displaying a sense of personal integrity and authenticity.	At this level, the patient internalizes their health-related values and consistently demonstrates them in their behaviors and decisions. For example, the patient might actively engage in self-management of a chronic illness, advocate for their health needs, and seek out additional resources or support to maintain their well-being even after leaving the hospital.

TABLE 3.4 The Five Levels of Affective Learning Processes in Bloom's Taxonomy

Affective learning involves developing attitudes, values, and beliefs and having emotional responses to learning. Effective teaching strategies for affective learning include using positive reinforcement, modeling positive attitudes, and creating a supportive and respectful classroom environment that values diversity and encourages students to express themselves. For example, a nurse has a patient who has just begun a recovery program for substance use disorder. The patient is skeptical about both group and individual therapy and tells the nurse they don't expect to get much out of it, but they agree to attend meetings. The nurse makes time every day to ask the patient about their feelings and encourage them to share both positive and negative ones. This teaches the patient that their feelings are valid even if they're not the "correct" ones, and that the patient is in a safe place where they can share without judgment.

Psychomotor Domain

The **psychomotor domain** involves acquiring physical skills and motor abilities. Effective teaching strategies for psychomotor learning include hands-on activities, role-playing, and practice exercises that allow patients to learn and practice new skills. For example, the nurse can role-play with a small child or older individual with developmental delays.

Evaluating Patient Learning

The goal of using Bloom's Taxonomy as a teaching tool is to help the patient build up from lower-level skills to higher-level ones. Learning outcomes target knowledge (cognitive domain), attitudes for change (affective domain), and skills (psychomotor domain). Learning outcomes are goals that can be short- or long-term. Success is measured by the patient reaching goals in successively higher levels.

LINK TO LEARNING

The Center for Academic Success at Louisiana State University (LSU) has recorded a short video on using Bloom's to think critically (https://openstax.org/r/77BloomsCrThVid) to explain Bloom's Taxonomy.

Document Teaching-Learning Process

Patient education is a regular part of patient care and must be documented as such. The nurse should document the steps and details of the teaching-learning process in the patient's chart. The general steps to be documented begin with the assessment of the patient's learning needs, followed by the teaching plan. Document the details of the teaching session itself, including the specific education covered, the patient's reaction to it, and any questions or concerns raised by the patient. Afterward, the nurse should evaluate the teaching session and document the results, including any follow-up that might be needed, in the patient's chart. Finally, if the patient did not achieve the learning objectives or has new learning needs, modify the teaching plan accordingly and document the changes made.

Summary

3.1 Therapeutic Communication

The process of therapeutic communication in nursing consists of several steps: develop communication goals, create the message, deliver the message, listen to the response, and seek clarification of the response. The primary characteristics of therapeutic communication are building trust through honesty, active listening, and respecting patients' beliefs and values. To evaluate therapeutic communication, one must reflect on the patient's response and compare the response to the desired communication goals.

3.2 Comprehensive Interview Practices

The four phases of a comprehensive interview are the preparatory phase, the introductory phase, the maintenance phase, and the termination phase. The best techniques the nurse can use during a comprehensive interview help the patient to answer questions without interrupting their flow of ideas; these techniques include asking open-ended questions, adaptive questioning, encouraging the patient to verbalize their feelings, and respecting the patient's values and beliefs. Finally, there are special considerations to recognize when conducting a comprehensive interview: age, cultural, and emotional issues can all add complex factors that nurses must take into consideration.

3.3 Patient Education and Teaching

The purposes of patient education and teaching are to promote positive patient outcomes, health literacy, and self-care. Many factors can affect patient learning, including the patient's learning needs, age and developmental level, and readiness to learn. The nurse's role in patient education and teaching involves determining effective teaching strategies, evaluating patient learning, and documenting the teaching-learning process.

Key Terms

active listening listening with the intent of understanding and discerning

adaptive questioning a form of open-ended questioning that helps to encourage a patient to fully communicate without interrupting the flow of their narrative

affective learning domain our attitudes, values, and emotions toward learning and how they develop

Bloom's Taxonomy a framework that helps the nurse to identify the key learning goals they want to achieve during each patient interaction

cognitive learning domain the understanding and development of information through application, moving up the taxonomy from basic recall to complex evaluation and creation

competitive listening behavior that happens when we focus on sharing our own point of view instead of listening to someone else

cultural awareness the recognition of the characteristics of one's own culture and other people's, and of the differences between them

health literacy an individual's ability to obtain, understand, and apply basic health information and services to make informed decisions about their health

introductory phase nurses introduce themselves and begin to obtain essential information about patients as individuals with unique needs, values, beliefs, and priorities; during this phase, trust is established and rapport begins to develop between the patient and the nurse

maintenance phase majority of the nurse's time with the patient; during this phase, nurses use active listening and begin by asking the reason the patient is seeking care; the answer helps to reveal what is important to the patient

message the thought or content that someone wishes to convey

nontherapeutic communication communication patterns or techniques that have negative effects on the development of a therapeutic relationship

nonverbal communication conveying a message without the use of words

open-ended questioning an interviewing technique that requires the interviewer to ask questions that prompt detailed answers from the interviewee

passive listening behavior that happens when we are not interested in listening to a speaker and we assume the speaker's message without verifying that we understand what the speaker is communicating

preparatory phase happens before the face-to-face meeting with the patient

psychomotor domain acquiring physical skills and motor abilities
teach-back method to have the patient re-state to the educator, in the patient's own words, the original message
termination phase the final phase of a nurse-patient relationship; typically occurs at the end of a shift or upon discharge from care
therapeutic communication the specific techniques and strategies used by nurses to establish a therapeutic relationship with patients and promote the patient's well-being
transparency being open and honest with the patient about their health conditions, treatment options, and potential outcomes
trauma-informed care care that considers the impact of trauma on an individual's physical, emotional, and mental well-being
validate reassure a patient that their emotions are natural and reasonable and their problems are understood and will be fully addressed
verbal communication the use of words to deliver a message

Assessments

Review Questions

1. What is a defining characteristic of therapeutic communication?
   a. Its direction is determined by the nurse.
   b. It is designed to lead to patient understanding and participation.
   c. It is supposed to challenge unhealthy beliefs and behaviors of patients.
   d. It should consist of the nurse asking the patient "why" about their health-related behaviors.

2. What is the first step in the therapeutic communication process?
   a. deliver the message
   b. create the message
   c. develop communication goals
   d. listen to the response

3. What is the best way to evaluate the effectiveness of therapeutic communication with a patient?
   a. have the patient explain their understanding of the conversation using the teach-back method
   b. have the patient fill out a survey about their experience
   c. ask the patient if they understand everything you talked about during the conversation
   d. chart your perception of the communication based on nonverbal cues

4. Mr. Padilla is a 62-year-old male patient. The nurse goes to give him medication and asks him how he is doing. Mr. Padilla responds, "Well, my head is all messed up since they gave me those test results yesterday." What would be a therapeutic response from the nurse?
   a. "Oh, I'm sure everything is going to be okay! Why don't you call your wife?"
   b. "Have you tried distracting yourself? You could watch TV or do some exercises."
   c. "Did you not sleep very well last night?"
   d. "I'm sorry, but I don't understand what you mean. Can you explain?"

5. The nurse enters the room and sees that the patient is on the phone crying. What is an example of appropriate therapeutic nursing behavior?
   a. The nurse smiles at the patient, closes the privacy curtains around the bed and quietly leaves the room.
   b. The nurse tells the patient to be mindful of other patients on the unit and to keep their voice down.
   c. The nurse says "Oh no, I see that you're upset. What's wrong?"
   d. The nurse says "You poor thing. Let me give you your medication and then I'll give you some privacy."

6. What technique best helps encourage a patient to fully communicate without interrupting the flow of their narrative?
   a. adaptive questioning

b. comprehensive interviewing
c. reflecting and restating
d. using silence

7. Why is age a special consideration when conducting a comprehensive interview?
a. Cognitive decline is a normal part of aging.
b. Different age groups have different physical, emotional, and developmental needs.
c. Comprehensive interviews are only appropriate for adults.
d. Basic communication techniques are the same across the life span.

8. When using _____ as an interviewing technique, it is essential to structure questions carefully to avoid leading the patient in a particular direction.
a. clarifying
b. confronting
c. restating
d. open-ended questioning

9. What is the purpose of patient education and teaching?
a. to teach patients the difference between right and wrong decisions to make on their healthcare journeys
b. to illustrate for patients in a positive way why traditional Western medicine is always the best choice
c. to educate patients to treat their conditions at home so that they don't use as many community health resources
d. to empower patients to become active participants in their health care, leading to better health outcomes and an improved quality of life

10. A nurse is preparing to educate a patient on how to use an insulin pen at home. The patient has already stated to the nurse that they are nervous about the needle in the pen and they learn best by practicing things. What is the best action for the nurse to take to provide useful education to this patient?
a. have the patient watch a short, informative video of someone using an insulin pen
b. give the patient some literature to read at home about how the pen works and the type of insulin that it contains
c. have the patient demonstrate assembling the pen and giving themselves the injection; ask them their comfort level with the procedure afterward
d. invite the patient to a support group for patients with diabetes so that they can get tips and support from others with the same issues

11. What is the most effective teaching strategy when using the revised Bloom's Taxonomy as a framework?
a. to place the greatest emphasis on the cognitive domain, as it most affects the learning process
b. to consider all three of the learning domains: cognitive, affective, and psychomotor, when developing a teaching plan
c. to adhere to strict learning goals and adjust patient behavior as needed
d. to take it slow and remember that an individual cannot move to a higher level without first comfortably completing a lower level

Check Your Understanding Questions

1. Describe the primary characteristics of effective therapeutic communication.

2. What should the nurse do if they determine that a therapeutic communication was ineffective?

3. What are some specific strategies to use while performing a comprehensive interview?

4. When conducting a comprehensive interview, what special considerations must be incorporated into the assessment?

5. What are some of the factors to consider when selecting educational material?

Reflection Questions

1. Which type of listening is best for therapeutic communication: active listening, competitive listening, or passive listening? Why?
2. The preparatory phase of the comprehensive interview takes place before the nurse even speaks to the patient. Why is it such an important part of the comprehensive interview process?
3. What is the purpose of using Bloom's Taxonomy for patient education?
4. What is the nurse's role in patient education?

Critical-Thinking Questions about Case Studies

1. Refer to Unfolding Case Study #1: Part 1.
   How might other aspects of her social history affect her overall health?
2. Refer to Unfolding Case Study #1: Part 2.
   Do you think the patient has a high level of health literacy? Why or why not?

Competency-Based Assessments

1. Break into small groups with fellow students and role play possible nurse-patient scenarios. For example, a nurse is educating a patient on a new medication. The interactions should be realistic and the "nurse" should attempt to maximize therapeutic communication strategies and minimize nontherapeutic strategies when dealing with the "patient." Have someone keep track of therapeutic vs nontherapeutic techniques used and see if you can improve your interactions over time. Were you able to improve your communication? Why or why not?
2. Review the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 4

Obtaining a Complete Health History

FIGURE 4.1 A comprehensive assessment reveals critical information about a patient. Data collection, documentation, and the use of informatics in nursing are the foundation for obtaining an accurate health history. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

CHAPTER OUTLINE

4.1 Foundations for a Complete Electronic Health Record: Accurate Health History

4.2 Data Collection and Documentation

4.3 Informatics

INTRODUCTION According to the U.S. Department of Health and Human Services, health records are used for a variety of both administrative and clinical tasks to improve patients' quality of care (2020). To avoid errors and inaccuracies in the diagnosis and treatment of a patient, it is imperative an accurate health history be obtained. While the health history is primarily used to better serve an individual patient, the information or data collected can have many other functions. Some of these functions include defining the medical facilities' services, guiding future facility growth, and establishing trends in current practice. This chapter discusses the processes involved in obtaining a complete health history, data collection and documentation involved in a health history, and informatics.

4.1 Foundations for a Complete Electronic Health Record: Accurate Health History

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify reasons that accurate health records are important
- Define and understand the important terms related to health records used in the healthcare industry
- Apply legal and ethical issues related to the health record

Nurses perform assessments to make professional judgments for the care of patients. The data collected during these assessments are recorded in a patient's health record. A **health record** is a collection of subjective and objective clinical information pertaining to a patient's physical and mental health, compiled from a variety of sources. The first stage of data collection is crucial to the proper execution of the remaining phases in the nursing process (Table 4.1).

I. Assessment	Collecting subjective and objective data and documenting in the health record
II. Diagnosis	Analyzing data to make and prioritize professional clinical judgments
III. Outcome Identification	Using the previous information to effectively predict outcomes
IV. Planning	Developing solutions, developing a care plan, and prioritizing outcomes
V. Implementation	Completing the planned interventions
VI. Evaluation	Assessing whether outcomes have been met and revising as needed

TABLE 4.1 The Nursing Process

According to the American Association of Colleges of Nursing's (AACN) *The Essentials: Core Competencies for Professional Nursing Education*, when nurses complete health assessments, they are doing more than just collecting information. Nurses use knowledge and comprehension to effectively analyze the data collected, and they then successfully apply clinical reasoning and improve patient care outcomes (AACN, 2021).

The Importance of an Accurate Health Record

A patient's health record includes previous and current information related to medications, treatments, tests, immunizations, surgeries, hospitalizations, and notes from visits to healthcare providers. Each healthcare organization has specific policies and procedures that detail the nurse's responsibilities regarding how and where to document. Health care's oldest and largest accrediting organization, The Joint Commission, recommends that all data related to the patient's assessment, diagnosis, care plan, and outcomes are collected and stored in the patient record (The Joint Commission, 2021). It is important that all information in a patient's health record is accurate. If the health record is inadequate or erroneous, a provider may make an incorrect clinical judgment that could adversely affect continuity of care and result in poor patient outcomes.

In health care, continuity of care is the process of delivering quality care by a coordinated provider-led medical team with the common goal of positive patient outcomes. The coordination of care among team members can occur with proper exchange of patient information across an interlinked healthcare system that allows for all parties to have access to the same information. Accurate patient health information allows for the continuity of care. Nurses are often responsible for obtaining the health history information as part of the initial admission assessment. Throughout the patient's plan of care, interdisciplinary team members will often add information to the patients' health record (Figure 4.2), building on the foundation developed by the nurse.

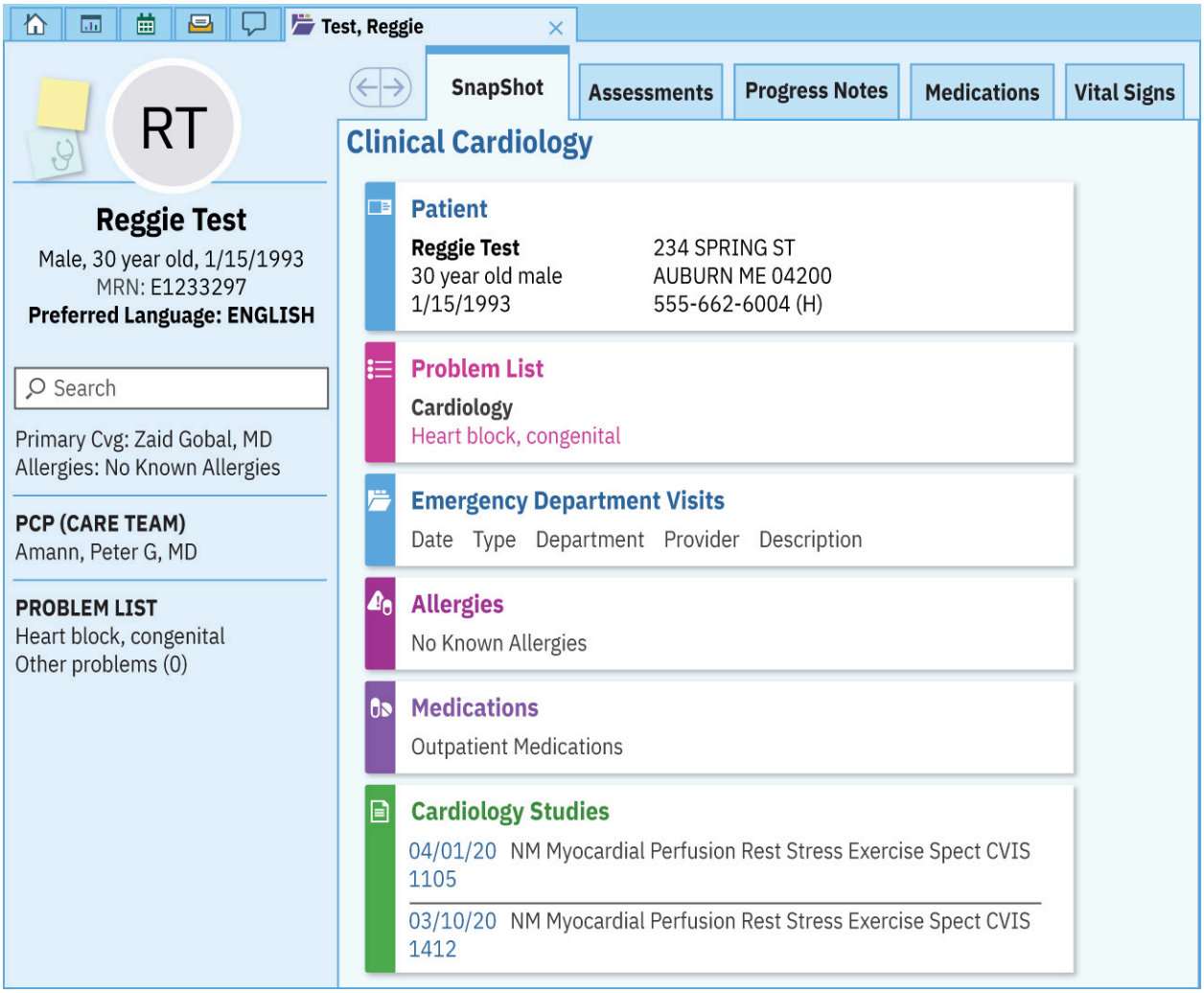

FIGURE 4.2 An electronic health record (EHR) captures all the patient's known health information to allow for continuity of care. EHR software will vary by facility; this is just one example. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

A health history begins with determining the patient's chief complaint or reason for seeking medical care. Nurses begin the assessment by asking a set of standard questions (discussed in 4.2 Data Collection and Documentation) and then documenting the patient's response, either on preprinted forms or in the EHR. Data collected are legally protected and can be used in court proceedings at any time and therefore must be accurate. Obtaining a valid and detailed health history requires effective communication and interviewing skills, which are discussed in 3.2 Comprehensive Interview Practices.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Patient-Centered Care

Definition: Recognize the patient or designee as the source of information and a full partner in providing compassionate and coordinated care based on respect for patient's preferences, values, and needs. The nurse will:

- Discuss principles of effective communication.
- Describe basic principles of consensus building and conflict resolution.
- Examine nursing roles in assuring coordination, integration, and continuity of care.

Let's take these QSEN Clinical Competencies and incorporate them into a patient care scenario. You are assigned a patient on the postsurgical recovery floor. During report, you learn your patient, Mr. Smith, a 66-year-old male, had open abdominal surgery thirty-six hours ago for gallbladder removal and a mesh hernia repair. He is due to be

transferred to the medical-surgical (med-surg) floor later this afternoon. The nurse giving report also states the patient has some visitors at the bedside, and they have been here a few hours. Upon entering the room, you notice that the patient is in bed, clutching a pillow over his abdomen and has facial grimacing. There are several people standing around the bed visiting with the patient, including his wife.

Assess:

Step 1: You walk in and introduce yourself to the patient. You ask the visitors to step out so you can assess Mr. Smith, and his wife interrupts you and speaks up saying, "Oh no they can stay, they are family and have just flown in this morning. We want them here."

You proceed to inform Mr. Smith you need to complete an assessment and would prefer to respect his privacy by having everyone step out for a few minutes. Mr. Smith's wife speaks up again and says, "They are not leaving, you can assess him with us here, just like all the other nurses have." Mr. Smith nods his head "yes" and says, "Please go ahead and do whatever you need to."

Step 2: You collect Mr. Smith's vital signs and notice that his blood pressure, respirations, and heart rate are higher than previous readings. You ask Mr. Smith to rate his pain level. As he starts to answer, his wife says, "Remember honey, with a pain level below three, you can get transferred to med-surg", then she proceeds to tell the visitors how much nicer the rooms are on the med-surg floor. Mr. Smith states, "My pain is two out of ten"; he has pursed lip breathing and has facial grimacing.

Diagnosis/Plan:

Step 3: Incorporating the knowledge you have regarding QSEN's Clinical Competency: Patient-Centered Care, what is your next step?

After reflecting, analyzing the situation, and thinking about consensus building, conflict resolution, and using the patient as your primary source of information, you make a decision.

Implementation:

Step 4: You tell the visitors and the patient's wife, "I must now insist you all step out for just a moment so I can complete a proper assessment." You explain that you need to expose Mr. Smith's abdominal area, and out of respect for his privacy, they really need to leave the room. You suggest they go get a cup of coffee or relax in the visitors' lounge for just a little while. The patient's wife and visitors reluctantly leave the room.

Assess: ***Note the nursing process is fluid, and previous steps can be revisited if needed.***

Step 5: You reassess Mr. Smith's vital signs, and they remain elevated.

- Blood pressure (B/P) 146/92
- Heart rate (HR) 117
- Respirations 28
- Temperature 98.4°F (oral)

You ask for his pain level again, and Mr. Smith starts to become tearful. He explains that his pain is really at an eight out of ten, but he does not want to disappoint his wife. She has been looking forward to being transferred to a bigger room, one with a bed she can sleep in, instead of a pull-out recliner. You assess Mr. Smith's incision, and the incision is well-approximated, no signs of drainage, and sutures are intact. His skin is not hot to touch and shows no signs of infection.

Diagnosis/Outcome Identification and Planning:

Step 6:

Based on collected clinical data, and the incorporation of patient-centered care, you determine Mr. Smith is experiencing pain, anxiety, and fear. Your chosen nursing diagnoses are as follows:

- Pain related to recent surgical incision as evidenced by grimacing, expression of pain, and guarding behavior

Intervention: Provide the patient pain medication as ordered.

- Anxiety related to increased pain as evidenced by apprehension to report pain, verbalization of stress and fear

Intervention: Provide patient education regarding pain's correlation to decreased healing. Provide education about the importance of seeking assistance when needed.

- Ineffective coping related to not reporting pain when assessed, not incorporating coping techniques, and inability to express feelings

Intervention: Teach the patient coping techniques such as guided imagery, reducing environmental stimuli, repositioning, and increasing mobility.

- Knowledge deficit: hospital policies related to lack of knowledge regarding pain and transfer to lower-acuity care floor

Intervention: Provide patient education regarding hospital policies and transfers. Explain that a transfer to medical-surgical floor is not just based on reports of pain but also based on a patient's needed level of care and recovery status post-surgery.

Implementation:

Step 7: You educate Mr. Smith that pain is an expected part of recovery; because of this, the provider has ordered as-needed pain medication to provide relief. You explain to Mr. Smith how suffering from pain can hinder healing, and there is no need to suffer. You ask Mr. Smith if he would like something to relieve his pain. He says "Yes, please!" Then you explain he has the following order:

- mild pain: acetaminophen 500 mg, 2 tablets PO Q6 hours PRN
- moderate pain: hydrocodone bitartrate and acetaminophen tablets, USP 5 mg/500 mg, 2 tablets PO Q6 hours PRN
- severe pain: morphine sulfate, 2 mg IV Q4 hours PRN

You provide education on the different medications and severity scales, then medicate according to provider orders and teach coping techniques to help Mr. Smith manage any future pain and keep it at a manageable level. You explain the hospital policy on transfer to other floors and how he does not need to be concerned with the criteria of transfer because that is the administration's job. You state his job is concentrating on his recovery. You educate on patient-centered care and how he is considered a valuable member of the care management team.

Evaluation:

Step 8: After giving Mr. Smith time for pain medication to take effect, you return to his room and reassess. Upon entering the room, you notice the lights and TV are off, and he is alone. Mr. Smith states his pain level is at a zero out of ten, and he was finally resting comfortably. He said he asked his family to take his wife home for some well-deserved relaxation time, which in return allowed him to get some too. Mr. Smith then proceeded to thank you for alleviating his fears and encouraging him to focus on recovery.

Types of Health Records

The health record can be in paper format using preformatted templates or in a digital format. Although once the primary method, paper records are no longer preferred for patient records, as they can be a barrier to effective communication among stakeholders due to lack of accessibility across multiple locations. Paper-based charting also does not meet current privacy standards for protecting a patient's health information. To promote patient-centered care, the American Recovery and Reinvestment Act of 2009 (ARRA) was developed. This was the first big push for healthcare institutions to switch from paper-based records to an EHR system. The **electronic health record (EHR)** is a digital format of a patient's chart that contains data related to the patient's medical history, diagnoses, medications, treatment plans, immunization dates, allergies, radiology images, and laboratory and test results. In April 2018, the Centers for Medicare and Medicaid Services (CMS) changed the name of the Medicare and Medicaid EHR Incentive Programs to the Medicare Promoting Interoperability Program to "focus on interoperability and improving patient access to health information" (CMS, 2018).

To be in compliance with the Health Insurance Portability and Accountability Act (HIPAA) and demonstrate meaningful use, a nationwide transition to EHRs was initiated. During this transition, many people use the terms

electronic medical record and *EHR* interchangeably, but they do represent different records. An **electronic medical record (EMR)** is the digital version of a patient's chart at any one practice. An EMR contains the patient's history with a specific provider, diagnoses, and treatments prescribed by all the providers of that practice. The EMR stays at that facility; it is not designed to be shared or transferred to other facilities (think *Medical*: stays at the medical office). The EHR, on the other hand, is more of a snapshot of the patient's entire medical history. The purpose of the EHR is to enable multiple healthcare professionals across different platforms to easily view the patient's health history, risks, health promotion, education, and actual long-term care issues (think *Health*: involves a team of professionals).

UNFOLDING CASE STUDY

Unfolding Case Study #1: Part 4

Refer to Chapter 3 Patient Communication and Interviewing for Unfolding Case Study Parts 1 to 3 to review the patient data. The nurse is providing care to a 28-year-old female patient who arrived at the walk-in medical clinic. The female patient speaks only Spanish and is accompanied by her bilingual, 10-year-old son. Following the initial assessment, the patient's respiratory status begins to rapidly decline.

Past Medical History	Patient is a mother of one, who cares for her child and mother in a small apartment. The patient's mother is homebound and is not present at appointment. Patient cleans houses to support her family, but income is inconsistent. Patient has an eighth-grade education and speaks no English. Medical history includes seasonal allergies, sinusitis, and two episodes of COVID-19 in the past two years. **Family history:** Patient's father is deceased, and patient's mother has Alzheimer disease, stage II. Patient's son is in good health, talkative, and attentive to his mother. **Social history:** Patient is primary caregiver for mother and adolescent. No other support systems available. Patient has difficulty shopping and making doctor's appointments due to lack of care for mother. Patient has difficulty communicating in English, but son translates for his mother. **No current medications and no known allergies.**
Nursing Notes	**2100: Assessment** Medical translator is present to assist with nurse and patient communication. Patient has become increasingly short of breath with conversation and appears to be in distress. Oxygen continues per nasal cannula at 2 L/min. Patient's son has become anxious and distraught at the decline in his mother's appearance. Son is asking many questions and has begun to cry. Son states that he wants to read his mother's medical records so that he can understand what is going on and explain it to her.
Flow Chart	**2130: Assessment** Blood pressure: 150/92 mm Hg Heart rate: 115 beats/minute Respiratory rate: 28 breaths/minute Temperature: 102.1°F (37.2°C) Oxygen saturation: 89 percent on 2 L nasal cannula Pain: 9/10–ear
Lab Results	None

Diagnostic Tests/ Imaging Results	Chest x-ray: bilateral infiltrates indicative of pneumonia Sputum culture pending
Provider's Orders	Transfer patient to nearest hospital for admission.

1. Recognize cues: Which findings from the information provided in the patient's health record are the highest priority at this time?
2. Analyze cues: The nurse is discussing the hospitalization with the patient and patient's 10-year-old son. Which statement by the son is most concerning?
   a. "I can take care of myself and my grandma at home. I don't want my Mom to worry."
   b. "I can help my Mom with her medicine when she gets home. Just tell me what to do."
   c. "If something happens to my Mom, I don't want to live either."
   d. "I'll make up my schoolwork if I have to miss school while my Mom is in the hospital."

Terms Used in Health Information

The type of data collected will determine where it is recorded in the EHR (Figure 4.3). Every healthcare facility has a policy that outlines the **minimum data set (MDS)**, which is the mandatory information that must be collected from every patient. MDS is mandated by CMS for long-term care and used as a quality measurement tool for care provided.

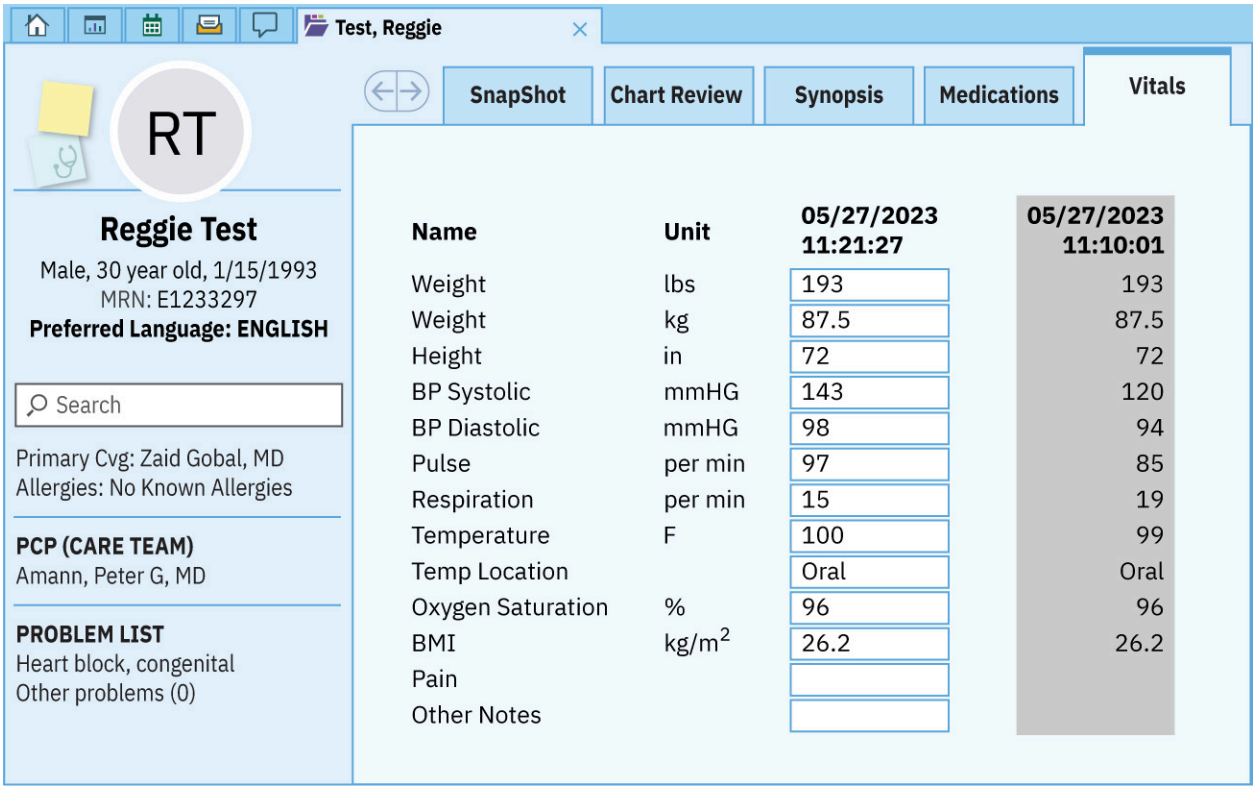

FIGURE 4.3 Nurses enter data into the EHR as individual facility policy outlines. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

When a nurse performs an **initial health assessment**, which is the systematic and purposeful collection and analysis of patient information, it begins with an accurate health history. The different types of nursing assessments are discussed further in 4.2 Data Collection and Documentation. Once data are recorded, a **health information**

exchange (HIE) can take place. HIE provides a vehicle for doctors, nurses, patients, and other interdisciplinary healthcare members to access and share critical healthcare information in a secure electronic platform with the goal of improving patient care. EHRs offer **interoperability**, or the ability to share patient information across multiple healthcare systems in digital format.

Legal and Ethical Issues Related to the Health Record

When collecting the patient's data, you are also responsible for safeguarding and keeping the information confidential. The **Health Insurance Portability and Accountability Act (HIPAA)** is a law that details national standards for sharing of information in the EHR and protection of privacy for health information (HHS, 1996). Legally and ethically, the patient has the right to privacy concerning their medical information. HIPAA regulations state that a healthcare facility may release protected health information without written consent in certain situations, such as the investigation and prosecution of a crime, public health and emergencies, research, judicial and administrative proceedings, and quality improvement, licensing, and regulation. While EHRs allow all healthcare professionals to easily access a patient's information from a variety of locations, many employers monitor and may even limit employee access to only those who have a need to know in order to complete their job. Most healthcare entities have policies and procedures in place regarding accessing a patient's information because electronic records are traceable, and all actions are discoverable. For instance, looking up a neighbor's or friend's information without being part of that person's healthcare team could result in serious consequences including termination and financial penalties.

During the initial assessment and collection of health history information, the nurse explains legal and ethical components of care. The patient is asked to sign consent forms allowing the facility to treat and provide medical care. The patient will also give consent to allow their information to be shared among healthcare entities such as pharmacies, insurance companies, and government organizations that will have financial responsibility for the medical costs, such as Medicare. Patients are asked if they have legal documents that dictate their preferred care, such as a living will or power of attorney. An **advance directive** contains the patient's wishes regarding life-sustaining medical treatments, and a **medical power of attorney** outlines who can make medical decisions on behalf of the patient in the event they cannot do so themselves. Last, all healthcare facilities have some form of the **Patient Care Partnership** (formerly titled a Patient Bill of Rights). This document informs the patient what to expect while receiving medical care under the organization and outlines their rights, such as the right to information, the right to privacy, and the right to accommodation of needs. The age of the patient will also determine if the nurse can collect data from the patient or if it must be from the parent or legal guardian. The **age of majority** is defined by each U.S. state as the age at which one can make their own decisions, including healthcare decisions.

The EHR is the nurse's best form of evidence detailing interactions with a patient. You have probably heard the saying, "If it is not documented, it did not happen," countless times as a nursing student (Ethicist, 2016). This is because attorneys consider the EHRs the most reliable and accurate representation of the patient care provided. EHRs can be **subpoena duces tecum**, or court ordered to be produced, years after the initial encounter took place. If pertinent information in the health history is overlooked and not documented, the nurse could be held liable if the patient has a poor outcome. Legal representatives can use incomplete documentation to prove care was not provided.

Ownership of the Health Record

Patients, physicians, nurses, and the entire healthcare team all have vested interests in the information within an EHR. However, there seems to be uncertainty at times regarding who actually owns the information. Many patients feel as if they do, seeing as the information is about them. Many healthcare organizations believe they do, because if it were not for them collecting, organizing, and utilizing the data, EHR would not exist. According to EHR communication guidelines, within U.S. states that fall under federal guidelines, the medical records belong to the provider, practice, or facility that created the record (Office of the National Coordinator for Health Information Technology [ONC], 2018). However, the information in the medical records belongs to the patient. Once the consent forms are signed, the patient can request access, usually required in writing.

LINK TO LEARNING

The American Nurses Association developed a checklist for streamlining documentation. Nurses can review the PDF for tips on how to document according to current practice standards and reduce errors. the document *Principles for Nursing Documentation: Guidance for Registered Nurses* (https://openstax.org/r/77principnurdoc) can help save time spent documenting and increase time spent with patients.

Nurse's Role in Maintaining Accurate Health Record

The nurse's role is to provide quality clinical care based on the foundation of healing. Effective communication among healthcare providers is an essential component in providing quality patient care. As you begin documenting the patient's health history, start looking for links, patterns, and connection of information that might otherwise be missed. Accurate recordkeeping is beneficial not only to the patient but to the entire healthcare team. It is important that difficulties the patient is having are documented, as well as what is or has been done to overcome these issues. For instance, if a particular intervention or medication has been ineffective in the past for the same condition, like a patient with a history of ear infections and multiple attempts of a particular antibiotic not being effective, then the patient should not have to repeat the same intervention again. Repeating unsuccessful interventions wastes time and money and diminishes the patient's trust in the healthcare team.

UNFOLDING CASE STUDY

Unfolding Case Study #1: Part 5

Refer back to Unfolding Case Study #1: Part 4 to review the patient data.

Nursing Notes	**2300: Assessment** Patient appears to be sleeping after first dose of IV antibiotics. Steroid injection administered, and coughing episodes have decreased. Oxygen per nasal cannula at 2 L/min. Social service referral made to address care and safety of minor child and dependent relative in the home. Transportation to hospital has been delayed due to tornado warning and storms in the area.
Provider's Orders	Close observation Administer IV antibiotic and steroid injection Prepare for transport to hospital
Nursing Assessment	**2330: Assessment** Patient's son stepped into hallway of clinic, asking for a nurse. During physical assessment, rash noted on patient's face with redness and facial edema, swelling of the tongue and throat, temperature of 100.5°F, irritability, and oxygen saturation of 96 percent.

3. Prioritize hypotheses: What finding by the nurse would be most concerning?
    a. swelling of tongue and throat
    b. facial rash
    c. temperature of 100.5°F
    d. pulse oximeter reading of 96 percent

4. Generate solutions: Based on the assessment findings, what should the nurse do next?

According to the *American Journal of Medicine*, the nurse spends more time with the patient than any other healthcare member (Butler et al., 2018). Nurses know that spending time with the patient is one way to uncover important health information that might not otherwise come up. The American Nurses Association lists patient advocacy as the "pillar of nursing" and considers it to be one of the most substantial reasons nurses are essential members of

the healthcare team (ANA, 2021). Completing an accurate health history and maintaining updates on any changes displays patient advocacy. The nurse also demonstrates being a patient advocate by maintaining confidentiality of the information in the health record.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Patient-Centered Care

Traditionally, documentation consists of timely and accurate charting. However, the QSEN-updated definition is expanded and calls for using information and technology to communicate, manage knowledge, mitigate error, and support decision-making.

Creating and maintaining an accurate EHR takes time, but the time nurses spend documenting may come at the expense of providing safe, quality patient care. In an effort to help alleviate nursing concerns related to the time spent documenting, an evidence-based tool is used to help streamline documentation.

UNFOLDING CASE STUDY

Unfolding Case Study #1: Part 6

Refer back to Unfolding Case Study #1: Part 5 to review the patient data.

Nursing Notes	**2400: Assessment** **Physical examination:** **HEENT:** Pupils equal, reactive to light, and accommodating (PERRLA), mucus membranes moist, pharynx without lesions, palate intact. No thyroid enlargement. Tongue swelling present. **Respiratory:** Course crackles in lower lobes auscultated bilaterally. **Cardiovascular:** Sinus tachycardia, no edema, peripheral pulses 2+. **Abdomen:** Bowel sounds present in all four quadrants, no tenderness noted. **Musculoskeletal:** No bone or joint pain reported, patient has full range of motion. **Skin:** Pale and dry, no bruising, facial rash subsiding. **Mental assessment:** Patient is lethargic but responding appropriately with help from interpreter.
Flow Chart	**0100: Assessment** Blood pressure: 140/82 mm Hg Heart rate: 105 beats/minute Respiratory rate: 24 breaths/minute Temperature: 100.1°F Oxygen saturation: 96 percent on 2 L nasal cannula
Provider's Orders	Diphenhydramine (Benadryl) 25 mg/min IV Q4 PRN for allergic reaction Close observation until discharge to hospital.

5. Take action: The nurse logs into the clinic computer to enter data obtained from the most recent assessment. The nurse steps away from the computer to answer the phone and leaves the patient's health information visible on the computer screen. What best describes this action?
   a. It could lead to a HIPAA violation for leaving private health information visible on a computer.
   b. It is not a HIPAA violation because the nurse was called away from the computer to attend to a patient in need.
   c. The nurse is not responsible for others who choose to take an unauthorized view of a patient's health records.

d. It could lead to a HIPAA violation unless the third party who viewed the patient records was another hospital employee, family member, or patient friend.

6. Evaluate outcomes: After administering medications as ordered by the provider, what assessment findings would indicate improvement in the patient's condition? What findings would indicate a worsening condition?

4.2 Data Collection and Documentation

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the major components of a complete health history
- Explain the difference between subjective and objective data
- Describe effective verbal and nonverbal communication techniques to collect patient data

Before meeting the patient and beginning the health assessment, the nurse should review the patient's health record, if it is available (Figure 4.4). Knowing the patient's demographic data is useful in deciding how to proceed with the assessment process. Information pertaining to past medical history, medications, and chronic diseases can be used to guide clinical decisions regarding current health status. Nurses should educate themselves regarding the patient's current medications or previous test performed to determine interview questions and apply critical reasoning. The nurse should validate all data with the patient and add to the information if needed.

FIGURE 4.4 Reviewing the patient's medical record is an important part of preparing for the assessment. (credit: modification of "Portable Information station, nurse, computer, hand wipes, 9th floor, Virginia Mason Hospital, Seattle, Washington, USA" by Wonderlane/Flickr, CC BY 2.0)

Once you have reviewed the patient's basic health data, it is time to take a moment and reflect on your own personal feelings. Sometimes patient situations can illicit personal feelings for the nurse. Examples of situations that may require the nurse to reflect on personal biases include:

- drug addiction
- mental illness
- teenage pregnancy
- active sexually transmitted disease(s)
- LGBTQIA+

- special needs or cognitive challenges
- obesity or lack of health consciousness

It is imperative that the nurse remove all personal biases before interacting with the patient. According to the American Nurses Association's *Nursing Code of Ethics*, personal biases can cause judgment, and the potential to project those judgments on the patient, and need to be avoided (ANA, 2022). Nurses should be as objective and open as possible when interacting with patients. Patients need to feel safe and free from negativity while receiving care.

Components of the Health History

During the assessment phase of the nursing process (see Table 4.1), the nurse completes four steps. The four steps include collecting subjective data, collecting objective data, validating the data, and documenting the data. Although there are four separate steps, they are fluid in nature and often overlap, and you may find yourself performing multiple steps concurrently. For example, you may ask your patient about skin concerns while you are inspecting their skin. If they answer that they do not have any concerns but you notice that the skin on the lower extremities is weeping (leaking fluid) and red, validation is initiated.

Documentation of data in the health record is broken down into different components.

The structure of health records can vary between practice settings, but they are all composed of these common components: demographic data, chief complaint or history of present illness, past medical history, past family and/or social history, and review of systems (ROS). Health records also contain areas to document current findings such as assessment data, diagnosis, treatment plans, and a follow-up plan for evaluation (Figure 4.5 and Figure 4.6).

PATIENT HEALTH HISTORY

PATIENT NAME: (First) _____ (Last) _____

ADDRESS: _____

DOB: _____ AGE: _____ GENDER: _____

CONTACT NUMBER: _____

EMAIL ADDRESS: _____

REASON FOR TODAY'S VISIT/SYMPTOMS

_____

Allergies *(list all drugs you are allergic to, and associated reactions)*

_____

Medications *(list all medications you are currently taking, including the dose and frequency)*

Prescription:

_____

Over-the-counter medications and dietary supplements:

_____

Hospitalizations *(list all hospitalizations, dates, reasons)*

_____

Surgeries *(list the type of surgery and date or age at the time of surgery)*

_____

Tobacco: Are you using tobacco products now or have you used them in the past?

Currently using: Circle YES or NO Type: _____ Date last used: _____

Illegal Drugs: Do you use any kind of illegal drugs, or have you used them in the past?

Currently using: Circle YES or NO Type: _____ Date last used: _____

Alcohol: How often do you consume alcohol? Circle: DAILY or WEEKLY or SOCIALLY or NEVER

Date last used: _____

PAST MEDICAL HISTORY *(circle the items that apply)*

Have you ever been diagnosed with any of the following?

Respiratory disease Gastrointestinal disease Cancer Cardiac disease Diabetes

Hypertension Psychiatric disorder Other

Date of diagnosis: _____

Circle the symptoms that you are currently experiencing.

Chest pain Trouble breathing Unexplained weight gain/weight loss Fatigue Headaches

Dizziness Sore throat Cough Nausea Muscle or joint pain Muscle weakness Other

When did symptoms start? _____

Substance use *(circle the items that apply)*

Alcohol Marijuana Drugs

Sexual history *(circle the items that apply)*

Sexually active in the past? YES or NO Sexually active currently? YES or NO

Multiple partners? YES or NO Sexually transmitted illness: HPV Herpes Chlamydia Gonorrhea Other

Do you use contraception? YES or NO

FIGURE 4.5 The nurse goes through all components when conducting a comprehensive health history. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Gynecologic history *(circle the items that apply)*

Menstrual period every month: YES or NO

Abnormal bleeding? YES or NO Cramps: None Mild Moderate Severe

Last PAP smear (date) _____ Abnormal PAP smears? YES or NO

Number of pregnancies _____

Last mammogram (date) _____ Result _____

Prescription hormone use? YES or NO Trying to become pregnant? YES or NO

Gynecologic symptoms Night sweats Hot flashes Vaginal dryness Mood changes Insomnia

FAMILY MEDICAL HISTORY

Has anyone in your immediate family (parents, grandparents, siblings) been diagnosed with any of the following?
Please circle any that apply and indicate the family member.

Arthritis Bleeding and clotting abnormalities Breast disease Depression

Cancer: Breast Colon Lung Prostate Skin Other

Diabetes Headaches Heart disease High cholesterol High blood pressure Lupus Mental illness

Migraines Stroke Suicide

FIGURE 4.6 The health history is comprehensive. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Subjective Data

The information a patient provides the nurse with can indicate diseases or conditions in the body. The **subjective data** is information obtained from the patient and/or family members and can provide important cues about functioning and unmet needs requiring assistance. Subjective data is considered a **symptom** because it is something the patient reports. Examples include pain, dizziness, sadness, hunger, or restlessness. The major areas of subjective data include demographic data, chief complaint, ROS, and the patient's past personal, family, and social history. Subjective data can be collected from a **primary source**, the patient, or from a secondary source. Examples of a **secondary source** include information obtained from the history section of the health record, or the patient's family. If data are gathered from someone other than the patient, the nurse should document where the information is obtained.

Demographic Data

The **demographic data** consist of identifying basic patient information. Data such as name, date of birth, contact information, race, gender, preferred pronouns, marital status, occupation, religion, allergies, and resuscitation status are included in this component. Other data in this section may include consent forms and the patient's health insurance or entity responsible for payment of services rendered.

Demographic data are used for both administrative and clinical purposes. Administrative examples include payment collection and confirming upcoming appointments. Clinical examples include health promotion, like cancer screening for certain populations. Demographic data should be reviewed with each patient encounter to ensure changes to the information are documented.

Patient's Chief Complaint

After recording the patient's basic information and reviewing it for accuracy, it is time to find out why the patient is seeking medical care. The **chief complaint** is a statement of the signs and symptoms that have caused the patient to seek medical attention. The chief complaint can be revealed through open-ended questioning. The interview technique of open-ended questioning involves more than a yes or no answer; it requires the patient to provide details in their response. Sample questions the nurse can ask are outlined in Table 4.2. Examples of a patient's response to an open-ended question about onset may include, "I have been unable to sleep for the last five nights," "I was planting rose bushes and a thorn stabbed my finger, and it has been throbbing for three days," or "Yesterday, I slipped coming down my stairs and hurt my back." Once the nurse has determined the patient's chief complaint, it is important to continue to probe for more detailed information surrounding the event. Avoid using questions that suggest a response from the patient, such as "Your pain is sharp, right?"; instead, the nurse should ask the patient to describe the pain in their own words.

Information Domain	Examples of Open-Ended Questions
Onset	"How long ago did this first begin"
Severity	"Please describe the pain"
Location	"Please explain exactly where the pain is located"
Self-care	"What medications have you taken for this" or "Please describe anything that has helped in the past"
Quality	"Please describe anything you do that makes it feel better or worse"
Duration	"When was the last time you experienced pain like this?"

TABLE 4.2 Examples of Open-Ended Questioning

The nurse should ask if the patient is taking an **over-the-counter medication**, or a medication that does not require a prescription, as well as an **alternative substance** such as a nonregulated herbal substance or homeopathic medication. It is valuable for the nurse to recognize that what Western medicinal practice considers "alternative" may be the mainstay of home remedies used for specific cultures and not alternative at all. A good question for the nurse to ask would be, "What nonprescription medications, herbal supplements, or vitamins do you currently take?" It is also important to remember that not all patients visit the physician's office because of an illness or acute event. Some patients are seeking health promotion such as routine examinations or yearly bloodwork. These patients would have a chief complaint documented as annual examination or routine physical appointment.

CULTURAL CONTEXT

Cultural Considerations When Collecting a Comprehensive Health History

Culture is complex and changes with external and internal influences. Meeting patients' cultural needs is just as important as meeting their physical needs. Mastering cultural competency is essential in providing high-quality care and improving patient outcomes. Nurses should ask questions related to the patient's cultural preference and traditions to improve patient care outcomes. Examples might include dietary preferences, or end-of-life issues. Nurses should attempt to extract information the patient might not be so forthcoming to share. Examples include how modesty or gender roles are practiced in a specific culture. Using therapeutic communication techniques, the nurse can build a trusting relationship that will enhance the patient's willingness to share information. Promoting cultural communication contributes to reducing racial and ethnic disparities (Weatherspoon et al., 2016).

Past Health

The past health component of a medical record addresses all of a patient's previous medical history including personal, family, and social history. The personal history component includes any diagnosis or previously experienced condition, treatment, or surgery. Some examples include diagnoses of diabetes, hypertension, myocardial infarction, pregnancy, or birth. The nurse should ask questions pertaining to childhood illnesses and immunizations to date, and any food, medication, or environmental allergies. Other examples of information include past surgeries or hospitalizations. Information regarding past health status allows the healthcare team to plan appropriate care for any present illness.

Family Health

The family history component contains information related to familial diseases or hereditary conditions. A **familial disease** tends to occur more often in a particular family. Familial diseases often have a genetic component affecting more members of the family than perhaps they would be affected by chance alone, for instance, high blood pressure or cholesterol. Consider the scenario that follows:

- A 42-year-old male patient presents to your clinic for treatment of consistently high blood pressure readings at home. The patient describes an active lifestyle and dietary choices that are nutritious in nature. He goes on to explain his father had high blood pressure and died of heart disease at age seventy-four years, and his mother, while still living, has had two strokes related to high blood pressure. Based on the patient's family health history and no other risk factors, it is considered his high blood pressure is familial in nature.

Hereditary Diseases

A **hereditary disease** is passed down from generation to generation. Some examples of hereditary diseases include Down syndrome, cystic fibrosis, Tay-Sachs disease, Marfan syndrome, and sickle cell anemia. It is important to ask the patient to recall any information regarding the health status of maternal and paternal grandparents, parents, and siblings. Often genograms are used to help visualize a patient's family history. Figure 4.7 shows a sample genogram.

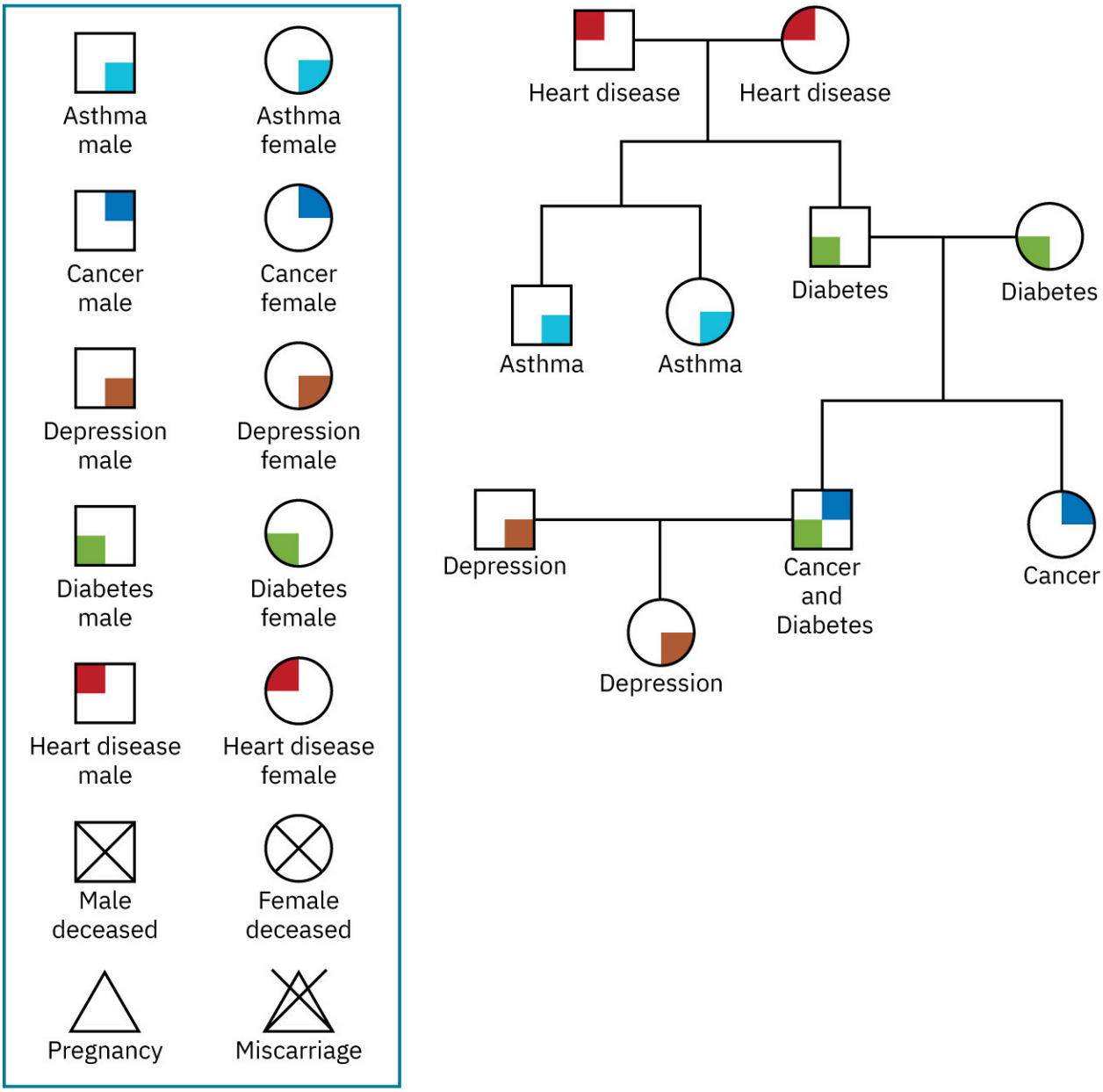

FIGURE 4.7 A genogram can help track a family history of diseases. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Social Health

The social history component includes the patient's lifestyle choices and daily behaviors. Questions related to diet, hobbies, alcohol and tobacco use, sexual history, or other behaviors that place a patient at risk can also be found in

this component. Health promotion education provided to a patient can often be derived from information discovered in the social history section of a health record. For example, if a nurse discovered a patient uses tobacco products, then they could provide smoking cessation education.

LINK TO LEARNING

The Agency for Healthcare Research and Quality has provided the "five A's" to intervention (https://openstax.org/r/77fivasinterv) as an example of how to coach patients for health promotion and disease prevention.

Review of Systems

A comprehensive review of each body system (ROS), such as cardiovascular, musculoskeletal, or urinary, can reveal information the patient may have forgotten to mention previously. Sometimes patients think information may be irrelevant and do not want to take up valuable time discussing what they think is not pertinent information. For example, brittle, peeling, or indented nails can seem like a harmless condition for most people, but it can also be a symptom of cardiac issues. Symptoms or questions related to certain diseases are included in this component. Asking the patient questions in terminology they understand will allow them to describe the status of each body system. A sample review of systems is shown in Figure 4.8 and Figure 4.9.

Review of Systems (ROS) Assessment Guide
NAME: **DOB:**
Height/Weight: ☐ recent weight changes
Allergies: ☐ environmental ☐ food ☐ medication What happens when exposed?
Skin, Hair, Nails: ☐ rashes ☐ lesions ☐ wounds ☐ ulcers ☐ tumors ☐ masses ☐ bruises/ecchymoses ☐ change in moles ☐ itching ☐ acne ☐ diaper rash ☐ burns ☐ temperature changes ☐ hair growth/loss
Eyes: ☐ glasses ☐ contacts ☐ pain ☐ excessive tearing ☐ itching/pruritis ☐ discharge ☐ swelling ☐ double vision ☐ blurred vision ☐ intolerance to light ☐ history of eye infections, cataracts, or glaucoma ☐ strabismus ☐ blindness
Ears: ☐ hearing impairments ☐ use of aids ☐ ear pain ☐ ringing/tinnitus ☐ wax/cerumen ☐ history of ear infections ☐ vertigo
Nose, Sinuses, Mouth, Throat: ☐ nose bleeds ☐ sinus infections ☐ sore throat ☐ tonsillitis ☐ voice changes ☐ hoarseness ☐ difficulty chewing or swallowing ☐ sores in mouth ☐ dentures ☐ cleft lip/palate ☐ dental history ☐ change in smell/taste ☐ mouth breathing/snoring
Neck: ☐ enlarged lymph nodes ☐ pain ☐ stiffness ☐ limited ROM
Breasts: ☐ lumps, masses ☐ thickening ☐ pain ☐ discomfort ☐ nipple discharge ☐ lesions ☐ rashes ☐ sores ☐ history of breast disease ☐ surgery ☐ breast self-exam Date and result of last mammogram: _____
Respiratory: ☐ shortness of breath/dyspnea ☐ cough ☐ sputum production ☐ bloody sputum (hemoptysis) ☐ wheezing ☐ history of COPD, tuberculosis, or lung cancer ☐ asthma ☐ use of home oxygen/equipment ☐ smoking/chewing tobacco history ☐ cystic fibrosis ☐ pneumonia ☐ bronchitis ☐ choking episodes ☐ apnea/sleep apnea
Heart: ☐ chest pain/angina ☐ palpitations, shortness of breath/dyspnea ☐ shortness of breath when lying down or at night ☐ fainting ☐ pacemaker ☐ history of murmurs/defects ☐ history of MI, CHF, hypertension, or rheumatic heart disease ☐ use of prophylactic antibiotics
Peripheral Vascular: ☐ swelling ☐ edema ☐ leg pain with walking ☐ numbness ☐ tingling ☐ changes in skin color ☐ history of phlebitis ☐ varicose veins ☐ hypertension
Gastrointestinal: ☐ normal bowel habits (frequency, color, amt, consistency) ☐ recent changes in bowel habits ☐ use of therapies (laxatives, stool softeners, diet, suppositories, enemas, other) ☐ nausea or vomiting (spitting up) ☐ hemoptysis ☐ belching ☐ flatulence ☐ abdominal pain ☐ abdominal distention ☐ heartburn ☐ indigestion ☐ loose stool ☐ diarrhea ☐ constipation ☐ bloody stools ☐ ostomies ☐ ulcers ☐ cirrhosis ☐ gallbladder history ☐ jaundice ☐ liver problems ☐ hernia
Urinary: ☐ loss of control ☐ difficulty starting stream ☐ pain ☐ burning/dysuria ☐ hematuria ☐ frequency ☐ urgency ☐ oliguria ☐ polyuria ☐ nocturia ☐ urinary tract infection ☐ benign prostate hyperplasia ☐ kidney disease ☐ pediatrics: history of toilet training: _____
Male Genitalia/Reproductive: ☐ sores ☐ lesions ☐ lumps ☐ masses ☐ discharge ☐ scrotal swelling ☐ TSE ☐ cancer ☐ congenital anomalies ☐ infertility ☐ contraception ☐ STDs

FIGURE 4.8 The ROS helps ensure that a patient has not forgotten an important component of their health history. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Female Genitalia/Reproductive: ☐ breast lesions ☐ lumps ☐ masses ☐ fibroids ☐ discharge
☐ menstrual history: age of first menstrual cycle: _____ ☐ last menstrual cycle: _____
☐ age of menopause: _____ ☐ gravida/para (PTAL) ☐ cancer ☐ infertility ☐ contraception ☐ STD
☐ pap smear results: _____

Hematolymphatic: ☐ bleeding problems ☐ bruises/ecchymoses ☐ petechiae ☐ lymph node swelling
☐ excessive fatigue ☐ blood transfusions ☐ cancer ☐ HIV ☐ healing problems ☐ hemophilia
☐ blood disorders: anemia, hyperlipidemia, high cholesterol

Endocrine: ☐ unexplained weight changes ☐ changes in hair, heat/cold intolerances ☐ polyuria
☐ polydipsia ☐ polyphagia ☐ thyroid history ☐ diabetes mellitus history ☐ adrenal disorders

Musculoskeletal: ☐ muscles (cramping, spasm, pain)
☐ joints (pain, swelling, redness, deformity, grating/crepitation, arthritis) ☐ scoliosis ☐ hip dislocation
☐ club foot ☐ gait ☐ special equipment (cane, walker, wheelchair)
☐ fractures, sprains, amputations, webbing ☐ current motor development (gross motor skills): _____

Neurological: ☐ fainting/syncope ☐ dizziness/vertigo ☐ balance difficulties/ataxia
☐ tics, tremors, spasms, muscle weakness/paresis ☐ paralysis ☐ memory problems ☐ hallucinations
☐ phobias ☐ disorientation ☐ headaches ☐ strokes ☐ seizures ☐ epilepsy
☐ difficulties with speech or speaking ☐ cerebral palsy ☐ muscular dystrophy

Mental Status: ☐ emotional illness or difficulty with thinking ☐ memory problems
☐ history of psychiatric illness such as anxiety, depression, schizophrenia

FIGURE 4.9 The ROS is lengthy but important. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LIFE-STAGE CONTEXT

Nutritional Status in Older Adults

The ability to smell and taste decreases with age. Medications and some degenerative conditions can also decrease sense of smell and taste in older people. Nurses should ask questions regarding current nutritional status and analyze correlation to age-related decreased sense of smell and taste (National Institute on Aging, 2020).

Suggested questions:

- How has your appetite been lately?
- Do you eat alone or with others?
- How many times a day do you eat?
- Do you use a lot of salt or sugar on your food?
- Can you taste sour or bitter things like you used to?
- Have you noticed a change in the way food smells?

Objective Data

Information observed through your senses of hearing, sight, smell, and touch while assessing the patient is **objective data**, also called signs. Examples include vital signs, laboratory results, and physical examination findings. Subjective and objective data are often collected and documented together. For example, if a patient says "I am feeling dizzy" and has a recorded blood pressure of 88/52, the feeling of dizziness is a subjective symptom, and the recorded blood pressure is an objective sign. It is important for the nurse to recognize the difference between subjective versus objective information. Table 4.3 provides a comparison.

Subjective Data (Symptoms)	Conceptual Problem	Objective Data (Signs)
Patient states, "I am worried about my breast cancer diagnosis. How do I tell my children and husband?"	Anxiety and coping	Patient presents with: • increased heart rate at 126 • increased respirations at 26 • clenched hands • poor eye contact and tear-filled eyes
Patient states, "I think may be sick. My skin feels warm, but I am so cold my body is shivering. My head and chest hurt."	Thermoregulation, oxygenation, and immunity	Patient presents with: • temperature of 101.8°F • pain rating of 8/10 for headache • productive cough with thick yellowish-green sputum • diminished bilateral breath sounds and rhonchi noted
Patient states, "I have been nauseous and had diarrhea for two weeks. The smell of food makes me want to vomit."	Fluid volume deficient, nutrition, elimination, and immunity	Patient presents with: • approximately 400 mL liquid brown stool with strong odor • stool sample positive for gram-positive bacterium: *Clostridium difficile* • recent laboratory work includes: ◦ BUN 50 mg/dL ◦ creatinine 1.3 mg/dL ◦ urine positive for ketones

TABLE 4.3 **Comparison of Subjective versus Objective Data Related to Coping**

Vital Signs and Anthropometric Measurements

The first set of objective data collected is called **vital sign**s, also known as cardinal signs, which are measurements of the body functions that are essential to maintain life. Vital signs frequently assessed and recorded by the nurse include temperature, heart rate, respiration rate, blood pressure, and pain level. Also recorded in this component of the health record are anthropometric measurements, a patient's height and weight. Each specific vital sign is discussed in detail in Chapter 15 General Survey, Anthropometric Measurement, and Vital Signs. Vital signs are the most important objective data to be collected (Sapra et al., 2022). Vital signs give the healthcare team an overall glimpse of what is going on inside the body at any given moment.

PATIENT CONVERSATIONS

What If Your Patient Appears Anxious about Routine Procedures?

Scenario: Nurse walks into the patient's room to complete an assessment and the patient starts exhibiting signs of fear and anxiety. The patient pulls the covers up to their chest and is clenching them tightly. The patient will not take

their eyes off the portable vital sign machine.

Nurse: Hi, my name is Sara, and I am going to be your nurse today. Do you mind verifying your name and date of birth for me?

Patient: uhm . . ., sure its Jon Blankenship and 01/12/1952. What are you going to do to me?

Nurse: Hi, Mr. Blankenship, I would like to assess your vital signs, if that is okay?

Patient: What does that mean? Does it hurt? Just a minute ago, they brought a machine in here and took blood from my finger and it still hurts. They said they were assessing my blood sugar levels, but I don't have blood sugar problems or diabetes. I am afraid you all do not know what you are doing, and I want to go home.

Nurse: Mr. Blankenship, I can understand your fear. Let me try and explain; we recognize you do not have a diagnosis of diabetes. Your physician wants us to monitor your blood sugar levels because the new medication he started you on for your chronic obstructive pulmonary disease (COPD) can cause blood sugar levels to get extremely high in some patients, and we just want to keep an eye on things for your safety.

Patient: Oh, well that makes sense. Then what is that machine for again?

Nurse: This is a portable vital sign machine that lets me check your heart rate, blood pressure, and temperature. If all is well, we only need to check your vital signs every six hours while you are here. If any of your vital signs changes drastically, then we may have to monitor more frequently. While obtaining vital signs does not hurt, the pressure on the blood pressure cuff can feel like a tight squeeze but won't last long. May I go ahead and complete them now?

Patient: It is okay. You can go ahead but go slow.

Scenario follow-up: The nurse collects the patient's pain level, heart rate, respiration rate, blood pressure, and temperature. She uses the bed scale to collect his current weight.

Nurse: Okay, I am done; your vital signs are good and are within the range of what we like to see. I know you said you want to go home. I understand being in the hospital is scary and not what you are accustomed to, but it truly is the best place for us to monitor your health right now. Do you think you would be willing to stay a bit longer with us?

Patient: Yes, I will stay for a little longer. It really is not bad here. I think, maybe, I just really miss my wife. We have been married 53 years and have never stayed a day apart.

Nurse: Would you like me to call her so you can talk to her on the phone? She is also allowed to come sit with you. We always encourage a loved one to visit. It helps with your healing process.

Patient: Oh, that would be wonderful! Yes, please call her, here is my phone number.

Physical Findings, Laboratory and Radiology Reports

A **physical finding** refers to the assessment of each body system. The nurse completes a head-to-toe organized approach to discover physical findings within each body system. Unit 4: Health Assessment and Promotion discusses each body system and accompanying assessment in detail. Other diagnostic information found in this component of the health record includes laboratory and radiology reports. Laboratory reports include data related to the body's blood and chemistry. Radiology reports consist of information related to x-rays, MRI, computed tomography, or any other form of imaging. Physical findings and laboratory and radiology reports can assist the nurse in determining correct interventions for the care plan as well as evaluating effectiveness of the selected intervention.

Diagnosis

The diagnosis component of the chart is where the provider will document the identification of any diseases or conditions. The physician will use information from all the components of the health record to determine a plan of action and diagnosis for the patient. It is important to remember the professional nurse does not provide the patient with a medical diagnosis. Only the physician and other advance practice certified providers, such as a nurse practitioner or physician's assistant, can provide a medical diagnosis. The medical diagnosis directs medical treatment and guides the whole healthcare team on how to treat the patient.

The professional nurse develops nursing diagnoses as part of the patient's plan of care. A **nursing diagnosis** describes a problem that a nurse can treat within their scope of knowledge, skills, and license. It provides guidance for the nurse on which interventions should be utilized to alleviate signs and symptoms associated with the medical diagnosis.

A **collaborative problem** is a certain physiological response the nurse monitors that can be addressed through nursing intervention and physician-prescribed treatments. This type of problem can be described as a potential risk for status, such as increased respirations or increased heart rate. Collaborative problems involve all healthcare team members to achieve the goal. Table 4.4 shows examples of all three types of diagnoses. This component of the health record is reserved for the medical diagnosis.

Patient has come into the emergency room and is experiencing a heart attack		
Medical Diagnosis	**Nursing Diagnosis**	**Collaborative Problem**
• Myocardial infarction without ST elevation	• Altered tissue perfusion • Fear • Pain • Deficit knowledge	• Dizziness • Dysrhythmias • Decreased urinary output • Fluid retention
What treatment is needed for each type of diagnosis, and who will complete the task		
• Laboratory and diagnostic testing is to be completed by the phlebotomy and radiology departments. • Medication is to be filled by the pharmacy and then administered by nursing. Oxygen therapy and management are to be delivered by the respiratory department.	• Nurse initiates continuous cardiac monitoring and anticipates the need for insertion of an arterial catheter, pulmonary artery catheter, or both to evaluate hemodynamic status. • Nurse provides emotional support and assists the patient in using positive coping strategies to reduce fear and anxiety. • Nurse informs the patient and family about the condition, treatment. • Nurse answers any questions they have clearly and in terms that they can understand.	• All healthcare team members will monitor the patient for safety risks and assist as needed. • Cardiac technicians will monitor the continuous telemetry and notify the nurse of any changes to rhythm. • Laboratory will complete the orders for bloodwork, and nursing will analyze the results and notify the physician of any critical values. • Nursing monitors urinary output for potential risks of kidney failure.

TABLE 4.4 Medical Diagnosis, Nurse's Diagnosis, and Collaborative Problems Medical diagnosis guides the overall treatment plan of the patient. Nursing diagnosis describes common patient problems associated with the medical diagnosis. Collaborative problems identify risk factors associated with a change in the patient's condition (Source: Amsterdam et al., 2014).

Treatment Prescribed, Progress Notes, and Patient Education

The next component of the health record includes treatment prescribed by the provider. A **treatment plan** is used to increase patient outcomes related to specific diseases or conditions. As these prescribed treatments are completed, it is recorded in the progress notes. The EHR can separate each progress note into a specific disciplinary team, such as provider, nurses, respiratory, and other ancillary departments. All interdisciplinary team members document treatments and interventions being done for the patient, as well as the patient's response to the treatment. This component of the health record is also used for any provided patient education. It is important to remember that the nurse should document exactly what the patient was educated on, how the education was provided, and how the

evaluation of knowledge received was determined.

PATIENT CONVERSATIONS

Patient Education

Scenario: Nurse walks into patient room to provide education on their newly prescribed diabetic diet.

Nurse: Hi, my name is Gwen, and I am going to be your nurse today. Do you mind verifying your name and date of birth for me?

Patient: uhm . . . , sure, its Mary Goodwright and 03/17/1972.

Nurse: Hi Ms. Goodwright, I would like to take some time and discuss your new diabetic diet. Is this a good time for you?

Patient: Sure, I am confused about what I can eat now. I think I may need to donate all the food in my house.

Nurse: I understand your concerns, and I am happy to explain your new recommended diet. Let me start by saying that you do not have to donate all the food in your home. I am sure we can come up with a plan.

Patient: Oh, thank you! I also love to bake with my grandchildren, will I still be able to do that?

Nurse: Of course, you can. I have a little video that we show all patients newly diagnosed with diabetes. I also have a brochure I want to go over with you. Would you like to watch the video now and write down any questions you have? I can come back in thirty minutes, and we can discuss it.

Patient: Yes, that sounds like a plan.

Scenario update: Nurse sets video to play on a handheld device and hands the patient paper to write on and a pen. Nurse leaves the room and returns in thirty minutes.

Nurse: Hi, so what did you think of the video?

Patient: I really enjoyed it; I learned a lot of new information, and I do not feel as scared about my diet change now. I think I can do this.

Nurse: That is wonderful! Here is some written information to follow up on the video just in case you get home and cannot remember what was discussed.

Patient: This is very helpful. Thank you.

Scenario update: Gwen answers all the patient's questions about the video instruction clearly and in terminology she can understand. Gwen goes over written material with the patient.

Nurse: Okay, Ms. Goodwright, I think you have a good understanding of your new diet. If you continue these changes in your diet and eating habits, it will have a positive effect on your health. Do you think you can name a few items from the store that you used to purchase and substitute in a more diabetic-friendly option based on your new knowledge?

Patient: Well, I previously would buy white rice and sweet cereal for breakfast. I have always eaten my white rice with butter and sugar for breakfast. Now, I will buy whole grain rice, and oatmeal for breakfast. Instead of the butter and sugar, I am going to add a few berries or yogurt. I have always loved fried chicken and a baked potato for lunch, but now I am going to switch to sweet potatoes and baked chicken breast. I have always been a big snacker, too. I love chips and cookies, but now I will snack on things like salty nuts or hard-boiled eggs.

Nurse: I am so proud of you! I see positive outcomes in your future.

Sample documentation: "Patient was educated on newly prescribed diabetic diet. Written material and visual instruction were used to educate the patient. Patient returned demonstration by correctly verbalizing several diabetic-friendly meal choices and repeated back information learned from the video presentation."

Documentation of the Patient Assessment

Documentation of information obtained in the patient assessment is a crucial step in the nursing process. The primary rationale for documentation is to facilitate effective communication between the interdisciplinary healthcare team members and guide quality patient care. Documented data are the foundation for formulating clinical reasoning regarding patient concerns, medical diagnosis, nursing diagnosis, and collaborative problems. Making decisions about patient care without the needed supporting documentation can result in poor patient outcomes.

The importance of documentation is addressed by each U.S. state's Nurse Practice Act, accreditation, and reimbursement agencies, such as The Joint Commission, and the Centers for Medicare and Medicaid Services (CMS). Healthcare facilities have developed policies and procedures that provide the nurse with not only the standards for what should be documented but also assistance in accomplishing the task. The components within the EHR are designed to ensure the nurse gathers all relevant data needed to meet the standards and guidelines for each individual facility.

REAL RN STORIES

Listening and Assessing a Patient

Nurse: Enoc, MSN, RN, Chief Nursing Officer
Clinical setting: Acute care hospital
Years in practice: 23
Facility location: Rural central Texas

Listening to your patient's concerns and assessing your patient are important for the overall care in a clinical setting. One time, I had assumed care for a 77-year-old male one evening in the emergency department (ED). He was being admitted for chest pain observation. He had initial complaints of burning on the left side of his chest.

Subjectively his complaints of pain and discomfort were taken as cardiac-related symptoms due to his age and previous cardiac history. On entering the room, I noticed that the patient was fully clothed, had a peripheral IV in his hand, and had a rapid triage done. On further inspection and visiting with the patient on his level of pain and description of "burning-like pain," I decided to place him in a gown. I did a complete assessment of his chest wall and noticed a linear rash on his left chest wall. The rash was painful to touch, and he described "burning" on the inside.

Using clinical judgment and analyzing the findings on examination, I collaborated with the ED doctor on his case. The patient was originally triaged as "chest pain" when in reality the patient was suffering from shingles. A complete cardiac workup had already been done. This lack of clinical judgment was not cost-effective, nor did it provide quality patient-centered care. As you navigate your nursing career, it is important to consider what the patient tells you (subjective data) and properly assess your patient's (objective) data to determine appropriate outcomes. Remember, as nurses, we are patient advocates, and much of our care direction is based on our ability to perform accurate clinical assessments.

The patient was discharged home with a prescription for his symptoms of shingles, and it was a learning moment for the team. This case enacted a quality improvement policy change in our ED; from that point on, all patients were to be placed in a gown and a full skin assessment was to be completed and documented.

Corrections or Alterations to Documentation

According to research, EHRs assist in patient diagnosis, reducing errors, improving patient safety, and supporting better patient outcomes (ONC, 2019). To improve risk management and prevent liability, the documentation must be an accurate representation of what took place within a patient interaction. Keeping in mind that a health record is a legal document, if an error is noted, it needs to be corrected immediately. Each healthcare facility will have a specific policy on how to correct an error in documentation. However, most require the nurse to make an entry and note the error, and then document the correct information. Here are some examples of documentation:

- **Documentation of expected findings:** *Patient denies any new onset of symptoms of headaches, dizziness, visual disturbances, numbness, tingling, or weakness. Patient is alert and oriented to person, place, and time.*

Dress is appropriate, well-groomed, and proper hygiene. Patient is cooperative and appropriately follows instructions during the exam. Speech is clear and facial expressions are symmetrical. Glasgow Coma Scale is 15. Gait is coordinated and erect with good balance. Pupils are 4mm, equal, round and reactive to light and accommodation. Sensation intact in all extremities to light touch. Cranial nerves intact × 12. No deficits demonstrated on Mini-Mental Status Examination. Upper and lower extremity strength and hand grasps are 5/5 (equal with full resistance bilaterally). Follows commands appropriately. Cerebellar function intact as demonstrated through alternating hand movements and finger-to-nose test. Negative Romberg and Pronator drift. Balance is stable during heel-to-toe test. Tolerated exam without difficulty.

- **Documentation of unexpected findings:** *Patient is alert and oriented to person, place, and time. Speech is clear; affect and facial expressions are appropriate to situation. Patient cooperative with exam and exhibits pleasant and calm behavior. Dress is appropriate, well-groomed, and proper hygiene. Posture remains erect in wheelchair, with intermittent drift to left side. History of cerebrovascular accident with left-sided hemiplegia. Bilateral hearing aids in place with corrective lenses on. Pupils are 4 mm equal and round. Reaction intact right and accommodation intact right eye. Left pupil 2 mm, round nonreactive to light and accommodation. Upper extremity hand grips, nonsymmetrical due to left-sided weakness. Right hand grip and upper extremity strength strong at 4/5. Left lower extremity residual weakness, rated at 1/5, right lower extremity strength 4/5. Sensation intact to light touch bilaterally, R > L. Unable to assess Romberg and Pronator drift.*

Communication with the Patient When Completing a Health Record

To be an effective healthcare member, a nurse must first learn to be an effective communicator. Good communication skills can lay the foundation for and maintain an established healthy working environment. Research proves maintaining a healthy work environment is directly linked to improved patient care outcomes and excellence in nursing practice standards (AACN, 2016). These standards include skilled communication: "Nurses must be as proficient in communication skills as they are in clinical skills" (AACN, 2016, p. 2). The same techniques used for communicating with your peers can be used to communicate with your patients.

To minimize data errors during the exchange of information, best practice techniques can be implemented when communicating. Communicate face-to-face with the patient, when possible, and maintain good eye contact (unless not culturally acceptable). After asking a question, allow the patient time to respond. Listen while the patient is talking. It is unprofessional to complete other tasks while the patient is communicating (AACN, 2016).

Verbal Communication

Verbal communication is the manner of exchanging information using oral or written words. A patient's use of verbal communication can identify important details such as education level, developmental considerations, or geographic or cultural origins. Nurses utilize verbal communication several ways when providing patient care. Examples include interactions between patients and family, giving shift reports to the relieving nurse, communicating with physicians, and evaluating interventions.

The Joint Commission has established the Situation, Background, Assessment, Recommendation (SBAR) model of communication as the gold standard for best practice when verbally exchanging information between healthcare team members. SBAR is one of the most widely used and recognized mnemonics within the healthcare industry (Shahid & Thomas, 2018). Figure 4.10 shows a sample SBAR.

SBAR MODEL OF COMMUNICATION	*PATIENT NAME:* _____ *DOB:* _____ *Department:* _____	***Handoff report given to other healthcare team members or used for communication to Provider***
SITUATION **S**	• I am calling about (patient) _____ • Current problem is _____ (Change in condition) _____	***Statement of situation: current problem or concern (objective data)***
BACKGROUND **B**	• The patient is a _____ (code status) _____ • Allergies include _____ • PMH includes: _____ • Recent diagnostics include: _____ • The patient is on: _____ (oxygen and/or IV fluids)	***Patient's background information: includes items such as code status, medications, allergies, any past medical history, or recent diagnostic tests (x-rays, MRI, sonograms, bloodwork, or labs) (objective data)***
ASSESSMENT **A**	• Current vital signs are: _____ • Focused assessment includes: _____ • Current IV sites: _____ • Current I/Os _____	***Assessment of patient; include current nursing assessment, identifying any deterioration of status***
RECOMMENDATION **R**	I suggest or request: • Provider or specialist assessment • Medication order • Transfer to different level of care	***Nurse's recommendation for next steps; statement of specific request related to the situation***

FIGURE 4.10 Following the SBAR model can improve communication among team members. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Nonverbal Communication

Information exchange without the use of words is called nonverbal communication, or body language. A patient's body language should be observed by the nurse to reveal nonverbalized issues or problems that need to be addressed. Body language includes one's posture, gait, level of eye contact, gestures, and facial expressions. For example, if a patient is holding on to the wall as they are walking, this could mean they feel unstable, and nursing intervention is needed. Another example might be if a patient is clenching their fist and pacing the room but states that "nothing is wrong." The nurse should document nonverbal communication as it is observed and what action was taken to resolve the issue.

If verbal and nonverbal communication misalign, the listener can receive confusing messages. The nurse should

ensure their own body language matches what they are verbalizing to the patient. For example, if a patient requests assistance to the bathroom and the nurse makes a disgusted facial expression, instantly the patient perceives unprofessional and disrespectful treatment. The patient might feel ashamed and embarrassed, neither of which is considered positive patient care outcomes. Patients need to feel safe and in a positive environment to heal; this includes positive nonverbal communication from the healthcare team.

Barriers to Communication

As the nurse begins communicating with the patient, assessment of any barriers should be conducted. Common barriers to communication include hearing or cognitive impairments, English as a secondary language, and cultural beliefs/practices. Questioning should be adjusted to adapt for any identified barriers. Using an interpreter, facing the patient when speaking, and not using medical terminology are common techniques to adjust communication for identified barriers. Social determents can also be barriers to communication and learning. Communication regarding healthcare management can be equal among patients, but that does not mean all patient outcomes are equal. The Patient Centered Assessment Method (PCAM) was designed to help identify social determinants that might affect a patient's ability to adhere or understand the importance of adhering to a health plan (Smeets et al., 2021). The PCAM is an evidence-based tool used to assess patient complexity using the social determinants of health. The tool helps validate why some patients engage in the managing of their health care, and why other patients do not. Many organizations are available to assist with questions regarding social determinants. Examples of social determinants linked to poor health promotion include housing, finances, and employment status which may help the nurse identify other factors that are affecting a patient's ability to manage their health. For example, if a patient is unemployed and has no transportation, this might explain the lack of seeking routine healthcare visits.

LINK TO LEARNING

The Centers for Disease Control and Prevention (CDC) published the Ten Essential Public Health Services and How They Can Include Addressing Social Determinants of Health Inequities (https://openstax.org/r/77CDCPubhealth) to help improve health inequities.

4.3 Informatics

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Explore the advantages, disadvantages, and capabilities of an EHR
- Define meaningful use and list the main components of meaningful use legislation
- Identify standard regulations relating to HIE

The field of **healthcare informatics**, or the field that incorporates health care and computer and information sciences, has drastically transformed the way the healthcare profession interacts (HIMSS, 2021). Communication is now transmitted through smartphones and web conferencing. Implementation of the EHR is one example of how the healthcare industry took advantage of this new digital platform. The seamless flow of information created by EHRs has changed the way patient care is delivered and how provided services are compensated. A few examples of how informatics has improved healthcare delivery include improved patient care outcomes, increased patient participation in health management, and improved care coordination among healthcare teams (Reid et al., 2021).

REAL RN STORIES

Nursing Informatics in Practice

Nurse: Gerald, CNS
Clinical Setting: Pediatric acute care
Years in practice: 28
Facility location: Major metropolitan area in southern Louisiana

Nursing informatics today is more important than ever in the clinical nursing world. As clinicians, we must adapt to

the ever-evolving EHR. From the bedside nurse to the executive leadership of a large hospital system, we use informatics to drive clinical practice and improve patient care outcomes. Often people wonder what the informatics nurse does behind the scenes.

As the Clinical Nurse Specialist of a large hospital system, let me tell you that informatics nurses are the bridge that connect hands-on clinical practice and information technology. They drive patient care outcomes and population health statistics and report data for government organizations, such as the Centers for Medicare and Medicaid Services.

One of the biggest drivers for me is patient satisfaction. Data gathered on real perceptions of patient experiences. The data are broken down into categories for improvement on a monthly basis. These experiences include things such as quiet at night, recommendation to others of the services provided by the hospital, education received about medications, and interactions with clinicians. Informatics nurses disseminate surveys to all the patients and then collect data to be analyzed. They then compare results to state and national averages. My department uses this information for quality improvement projects and unit-based policy changes.

Another important aspect of nursing informatics is improving workflow for the EHR based on users' recommendations. Hospitals have regulatory bodies that complete accreditation visits in person on an annual basis, if not biannually. The accrediting bodies want data and the ability to review patient charts. As a Clinical Nurse Specialist, I would not have the ability to paint the full picture of what was done to the patient, their positive outcomes, and financial revenue without the use of informatics.

Capabilities of an Electronic Health Record

The ability to share real-time patient information means the physician can access critical data no matter their physical proximity to the patient. A provider can be in their offsite office and access the hospital's EHR system remotely to analyze critical diagnostic results. The healthcare team can confidentially and securely share information about the patient's status change or vital health history. A decreased likelihood of errors exists because all providers have access to the patient's most current medication list. For example, if a patient is seeing one primary physician and three specialty physicians, they can all have access to all prescriptions, resulting in a decreased probability of duplicative treatment and medication errors. Patients receive a more tailored and individualized plan of care because of real-time data exchange. Fewer forms are needed if the patient is transferred between facilities, as the electronic version is constantly updated and transferred with the patient.

One of the newest capabilities of the EHR is patient engagement. Many providers give patients access to their EHR, allowing a more patient-centered approach to care. This permits patients the capability to answer their own questions immediately, instead of waiting for office personnel to return a call. Patient access to the EHR also allows for direct and private messaging to their providers.

LINK TO LEARNING

The Technology Informatics Guiding Education Reform (TIGER) (https://openstax.org/r/77techinformatic) initiative created by the leaders in healthcare informatics (Healthcare Information and Management Systems Society) has helped transform nursing informatics through personalized interactive learning resources. The TIGER Virtual Learning Environment is a free tool where students can watch webinars, access the resource library, and even take a free self-paced certification course.

Advantages

According to the American Nurses Association, care coordination among interdisciplinary healthcare members can be enhanced with incorporating electronic health records (Nelson & Parker, 2019). All departments have access to "real-time data" of vital information, without the need to wait for data transfer between departments. Primary care providers can easily distribute patient information to referrals or specialty care providers, without the previous lags in delivery. Clinical reasoning is improved because of access to more patient data, allowing for more well-informed decision-making and reduced safety risks. Additional advantages include efficient documentation that is legible; ability to collect and store data to be used for analytics; and built-in features, such as clinical decision support tools,

electronic prescribing, and real-time data transfer to patient portals.

Disadvantages

Among the widespread advantages of EHRs, there are a few disadvantages. Technical challenges required healthcare entities to develop their own information technology departments to handle these issues when they arise. Incorporation of the EHR has brought forth the need for policy revisions, organizational restructuring, and financial investment. These challenges, while adaptable, can be overwhelming to healthcare institutions. One of the most notable disadvantages of the EHR is related to user-related issues and design flaws. While informatics leadership has said that improved training and healthcare clinicians incorporated in the design process can alleviate these issues, it is still worth mentioning as one of the most cited disadvantages (Green, 2019). EHRs may also be a barrier to patients, particularly those who are unfamiliar with technology.

Meaningful Use and the Health Information Technology for Economic and Clinical Health Act

The **Health Information Technology for Economic and Clinical Health (HITECH) Act**, enacted as part of the American Recovery and Reinvestment Act of 2009, was signed into law on February 17, 2009. The main purpose of the HITECH Act is to promote meaningful ways to incorporate health information technology while still protecting patients' privacy rights. It is important to note the HITECH Act played a significant role in the adoption of EHRs. They developed five main goals to help achieve this objective:

- The first goal is aimed at improving how, why, and where information technology should be incorporated.
- The second goal focuses on patients being active team members in their own care.
- The third goal was designed to improve care coordination among various interdisciplinary team members.
- The fourth goal is focused on improving population health through health information technology.
- The fifth goal ensures privacy standards are incorporated through evaluation of security measures when using electronic health information.

Using electronic health information in a meaningful way to improve patient care is known as **meaningful use**. The U.S. government developed minimum standards defining ways in which healthcare information could be used. These standards outline how the exchange of information among providers, patients, and insurers should take place. There are five pillars of health outcomes that support meaningful use (Figure 4.11) (Particle Health, 2023).

FIGURE 4.11 The five pillars for meaningful use defines the exchange of healthcare information between providers, patients, and insurers. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Releasing Health Record Information and Health Information Exchanges

Release of information (ROI) in health care is critical for quality patient care and positive patent care outcomes. The ROI plays a role in reporting between entities, researching current best practice standards, and billing for services provided. The Department of Health and Human Services' Office of Civil Rights (OCR) ensures HIPAA privacy laws are applied to the release of healthcare information and the surrounding usability. The term **usability** refers to the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use. A few of the steps involved in ROI include following quality control regulations between sender and receiver, validating data being released, and sending the information in a timely manner. Failure to follow the guidelines outlined by the OCR and incorrectly releasing health information can violate privacy policies and result in noncompliance penalties.

Health Information Exchange

A health information exchange (HIE) allows for the exchange of health-related information among all stakeholders involved. HIE allows patients and healthcare team members to exchange information safely and securely. The healthcare entities must be extremely careful when releasing a patient's health information. Nurses should verify that consents to release information are signed by the patient. Nurses should pay particular attention to release requests involving anyone under the state's designated age of majority.

There are currently three identified rationales for health information exchange: directed exchange, query-based exchange, and consumer-mediated exchange (ONC, 2019). Directed exchange is used for sending public data regarding immunizations to local and state public health organizations or for direct reporting to CMS for the purpose of quality control initiatives. Directed exchange is also used for sending pertinent health data between providers. Query-based exchange is used to research best practice standards and clinical sources by providers when delivering patient care. For example, if a provider is faced with a disease or condition they are not accustomed to treating, they can access the research databases on current practice guidelines. Consumer-mediated exchange allows the patient access to their own health information. This form of HIE allows the patient the ability to monitor their own health, identify any mistakes in the demographic information, and make sure billing information is current.

Summary

4.1 Foundations for a Complete Electronic Health Record: Accurate Health History

In every healthcare setting, a health history is taken from each patient and updated regularly. The nurse establishes a trusting relationship with the patient to elicit exact and detailed information to build the foundation of an accurate health record. Often it is the nurse's responsibility to determine whether the information is valid and reliable and then use professional clinical judgment on the observations and data collected. Application of legal and ethical considerations will guide clinical decision-making. The information gathered and documented is also used by the provider to diagnose and develop a plan of care based on current industry standards and best practice guidelines.

4.2 Data Collection and Documentation

The act of recording patient information discovered in a complete health history is called documenting. Once the nurse understands that the purpose of accurate documenting is to facilitate patient care among the healthcare team, then the nurse can identify what information to document. Patient information can be categorized into subjective and objective data. It is important to remember each healthcare facility will have policies and procedures related to documentation expectations. Additionally, nurses need to master communicating assessment findings in a clear and precise manner to improve patient care outcomes.

4.3 Informatics

The incorporation of informatics with an EHR has drastically improved our healthcare system. As you incorporate the capabilities of an EHR into your daily clinical practice, remember regulations such as meaningful use and privacy laws. Nurses are at the forefront of patient care and often the eyes and ears of when something is not being done correctly. Using knowledge about how and when to release or discuss patient health information will ensure positive patient outcomes.

Key Terms

advance directive legal document that lists the patient's wishes regarding life-sustaining medical treatments
age of majority defined by each U.S. state as the age at which one can make their own decisions, including healthcare decisions
alternative substance nonregulated herbal substance or homeopathic medication
chief complaint statement of the signs and symptoms that have led the patient to seek medical attention
collaborative problem a certain physiological response the nurse monitors that can be addressed through nursing intervention and physician-prescribed treatments
demographic data identifying basic patient information
electronic health record (EHR) digital format of a patient's chart that contains data related to the patient's medical history, diagnoses, medications, treatment plans, immunization dates, allergies, radiology images, and laboratory and test results
electronic medical record (EMR) single facility's digital version of a patient's chart
familial disease disease that tends to occur often in particular families
health information exchange (HIE) vehicle for doctors, nurses, patients, and other interdisciplinary healthcare members to access and securely share critical healthcare information electronically, improving the speed, quality, safety, and cost of patient care
Health Information Technology for Economic and Clinical Health (HITECH) Act a law that promotes meaningful ways to incorporate health information technology while still protecting patients' privacy rights
Health Insurance Portability and Accountability Act(HIPAA) law that details national standards for electronic healthcare transactions and protection of privacy for health information
health record collection of subjective and clinical information pertaining to a patient's physical and mental health, compiled from a variety of sources
healthcare informatics field that incorporates health care and computer and information sciences
hereditary disease disease passed down from generation to generation
initial health assessment systematic and purposeful collection and analysis of patient information
interoperability the ability to share patient information across multiple healthcare systems in digital format
meaningful use using electronic health information in a meaningful way to improve patient care

medical power of attorney legal document that outlines who can make medical decisions on behalf of the patient in the event they cannot do so themselves
minimum data set (MDS) standard established by healthcare institutions that specifies the information that must be collected from every patient
nursing diagnosis clinical judgment based on the medical diagnosis of a patient that helps the nurse determine the plan of care
objective data (also, signs) information observed through your senses of hearing, sight, smell, and touch while assessing the patient
over-the-counter medication medication that does not require a prescription
Patient Care Partnership document that tells the patient what to expect while receiving medical care under the organization and outlines their rights; formerly called a Patient Bill of Rights
physical finding the assessment of a body system
primary source the patient
secondary source information obtained from the history section of the health record, or the patient's family
signs (also, objective data) information observed through your senses of hearing, sight, smell, and touch while assessing the patient
subjective data (also, symptom) information obtained from the patient and/or family members and can provide important cues about functioning and unmet needs requiring assistance
subpoena duces tecum court order to produce documents or records
symptom (also, subjective data) information obtained from the patient and/or family members and can provide important cues about functioning and unmet needs requiring assistance
treatment plan used to increase patient outcomes related to a specific disease or condition
usability extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use
vital sign a marker of physiological homeostasis and essential in the analysis of monitoring patient progress; obtained by measuring body temperature, pulse, respiratory rate, and blood pressure

Assessments

Review Questions

1. Is this statement true or false? The EHR is meant to stay at a specific practice and not be shared among the healthcare team.
   a. True
   b. False

2. A nurse is documenting the care given to a patient who is being seen for recent high blood pressure readings at home. What information should be documented for an accurate health history?
   a. a higher blood pressure reading for the first-time patient
   b. patient probably does not know how to take a blood pressure
   c. nurse instructed patient to stop being so stressed, everything will work out
   d. patient's arm circumference

3. Healthcare institutions are not required to obtain written consent to release personal health information in certain situations. Per HIPAA regulations, what is an example of one of those situations?
   a. A movie star is hospitalized, and their fans want to know the prognosis.
   b. A new variant of COVID is being reported, and a local nonprofit wants to track the outbreak to provide care packages to community members.
   c. Abuse of a child is suspected, and the police department and coroner have requested the health record.
   d. A man wants to verify no previous serious health conditions in his girlfriend's health record before proposing for marriage.

4. A nurse gets a text message from a friend. The friend asks the nurse to verify if one of their children's classmates has been admitted to the hospital. How should the nurse respond?

a. "This really crosses the line; I could get fired for telling you. Do you want that on your conscience?"
b. "I can send the requested healthcare information shortly."
c. "I am bound by HIPAA laws and not supposed to tell you who is or is not in the hospital receiving care."
d. "I am sure they will post on the public social media page, and you can confirm there."

5. What document allows a patient's medical wishes to be carried out when they can no longer answer for themselves.
a. advance directive
b. power of attorney
c. beneficiary
d. Patient Care Partnership

6. Is the following statement true or false? The patient's understanding and perception of problems should be recorded while documenting data.
a. True
b. False

7. The nurse is attempting to educate a patient regarding a new diagnosis. The patient is playing games on their phone and appears uninterested in learning new knowledge at the moment. What action by the nurse promotes positive communication techniques?
a. Ask the patient if they have a preference on what time you should come back to provide education.
b. Tell the patient to put up their phone and pay attention.
c. Ask the patient if there is someone else you can educate and then have them pass along the information later.
d. Stand and display nonverbal gestures until the patient puts up their phone and begins to listen.

8. What type of data typically consist of the patient's name, age, occupation, ethnicity, and support systems or resources?
a. demographic
b. past family
c. past medical
d. social media

9. What group of data can be identified as symptoms, or subjective data?
a. respirations, blood pressure, temperature
b. oxygen level, pain level, red blood cell count
c. itching, dizziness, chest pain
d. skin turgor, peripheral pulses, breath sounds

10. A nurse is working as part of a team that has been asked to address the issue of confidentiality and documentation of health information electronically. Which activity would the nurse suggest ensuring confidentiality?
a. promoting the sharing of printers among several units
b. allowing confidential emails to be sent via a public network
c. ensuring each person responsible for documenting in the EHR does not share their password
d. placing computer screens where all patients can view while waiting to be seen

11. A nurse is using video communication with the specialty physician involved in the care of her primary care clinic. According to the five pillars for meaningful use, which pillar does the nurse's action represent?
a. Coordination of Care
b. Engage Patients and Family
c. Ensure Privacy and Security
d. Improve Population Health

Check Your Understanding Questions

1. Describe how you can incorporate the five pillars of meaningful use into your daily clinical setting.
2. Describe ways you can improve population health outcomes through informatics.

Reflection Questions

1. Use the internet to research standard regulations relating to HIE. Discuss how these processes are helping people achieve their health goals, and the advantages of each.
2. Develop a fifteen-minute presentation defining the nurse's role in the exchange of health-related information and its contribution to quality patient care.

Critical-Thinking Questions about Case Studies

1. Refer to Unfolding Case Study #1: Part 4.
   How would you handle the son's request to review his mother's health records?

What Should the Nurse Do?

1. If a nurse maintains records that are incomplete, vague, and just generally do not make sense, this gives the impression they are not invested in the patient's care or their safety. What can the nurse do to provide patient-centered care and ensure the records are written following the American Nurses Association guidelines?

Stacy is a young adult with a history of many childhood allergies, including grass, trees, and animal dander. She is currently spending the summer at her grandparents' lake house before starting college this upcoming semester. Stacy has been experiencing a runny nose and itchy eyes since arriving at the lake house. She approaches her grandmother to inform her she was stung by a bee while fishing on the dock with her grandfather. Stacy feels too bad to drive and asks her grandmother to take her to a local clinic. You are a nurse working in the Family Practice Clinic when Stacy comes in with her grandmother for an evaluation. The grandmother says Stacy has already taken Benadryl 25 mg by mouth and rubbed hydrocortisone cream on the insect bite. As a nurse, it is important you take an accurate history regarding Stacy's previous reactions to insect bites. Your clinic is part of a larger hospital system, and you can access Stacy's EHR from her normal primary care physician's office in the city where she resides. You determine she has a previously documented history of an allergic reaction to a bee sting three years ago.

2. What other information might the nurse need to detail regarding the previous reaction?
3. Stacy is over age 18 years, so she is of the legal age of majority and can be responsible for answering medical questions and making her own medical decisions. However, the grandmother wants to be in the room while care is delivered. What should the nurse do?

Competency-Based Assessments

The Patient Centered Assessment Method (PCAM) (https://openstax.org/r/77PCAM) is a tool used to assess patient complexity using the social determinants of health. Questions regarding social determinants may help the nurse identify other factors that are affecting a patient's ability to manage their health. After reviewing the PCAM tool, test your competency by answering the following questions:

1. How does a patient's environmental status affect healthcare management?
2. How does employment status affect a patient's engagement in healthcare promotion?
3. Working in a small group, role-play how to complete a health history. Each member will role-play a different character: the nurse role, the patient role, and the observer role. You will role-play obtaining a complete health history. After each turn, the observer role will critique the group's actions and provide positive guidance on any omitted criteria. Then you can switch roles and repeat the process until everyone has completed each role in the scenario.
4. Assessing your knowledge and comprehension on a particular subject and then analyzing and applying that knowledge to patient care is an essential competency in nursing. Using the active learning strategy of role-play, work with another peer and attempt to act out the following scenarios. Using only nonverbal

communication, one of you pick a patient prompt and the other respond with a nursing prompt—remember that only nonverbal communication can be used.

Patient prompts:

- My foot is hurting.
- I cannot breathe.
- I want to go home.
- I am scared.
- I love this hospital!

Nursing prompts:

- Display empathy.
- Display disgust.
- Display concern.
- Display a sense of urgency.

After completing the scenario, assess your comprehension by discussing any struggles to complete these tasks. Then, as a group, collaborate on ways to become more self-aware of the application of nonverbal communication in any given situation.

5. Pick a peer and quiz each other over the advantages, disadvantages, and capabilities of an EHR.

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CHAPTER 5

Cultural Competence and Assessment

FIGURE 5.1 A culturally diverse community finds its strengths in its differences. (credit: "School diversity many hands held together," by "Wonder woman0731"/Flickr, CC BY 2.0)

CHAPTER OUTLINE

5.1 Understanding Cultural Differences
5.2 Ethical Practice in Culture and Diversity
5.3 Cultural Practice in Nursing
5.4 Diversity, Equity, and Inclusion

INTRODUCTION Every person in the world belongs to a culture. Culture shapes one's personal identity, influences social relationships, and contributes to the overall richness of human societies. Basic elements of culture include language, symbols, societal norms and customs, beliefs, values, and cognitive elements (such as learning to cope, managing difficult situations, and qualities taught to children). Culture plays a significant role in health and wellness, as it can affect what types of medicines and treatments to use, who is allowed to provide care, and beliefs about what causes illness and injury.

The United States has long had a reputation as a multicultural nation, and according to the United States Census Bureau (2020), it continues to grow even more racially and ethnically diverse every year (Jensen, 2022) (Figure 5.2). Nurses will interact with patients who belong to diverse cultures, both distinct from each other and distinct from the nurses' own cultural background. It is crucial for nurses to understand and accommodate cultural differences, ensuring the delivery of the best possible care to all patients, regardless of their cultural background. This chapter discusses how to gain a better understanding of cultural differences among the patients who nurses serve as well as ethical and cultural practices in nursing and how to incorporate diversity and inclusion as best practice standards.

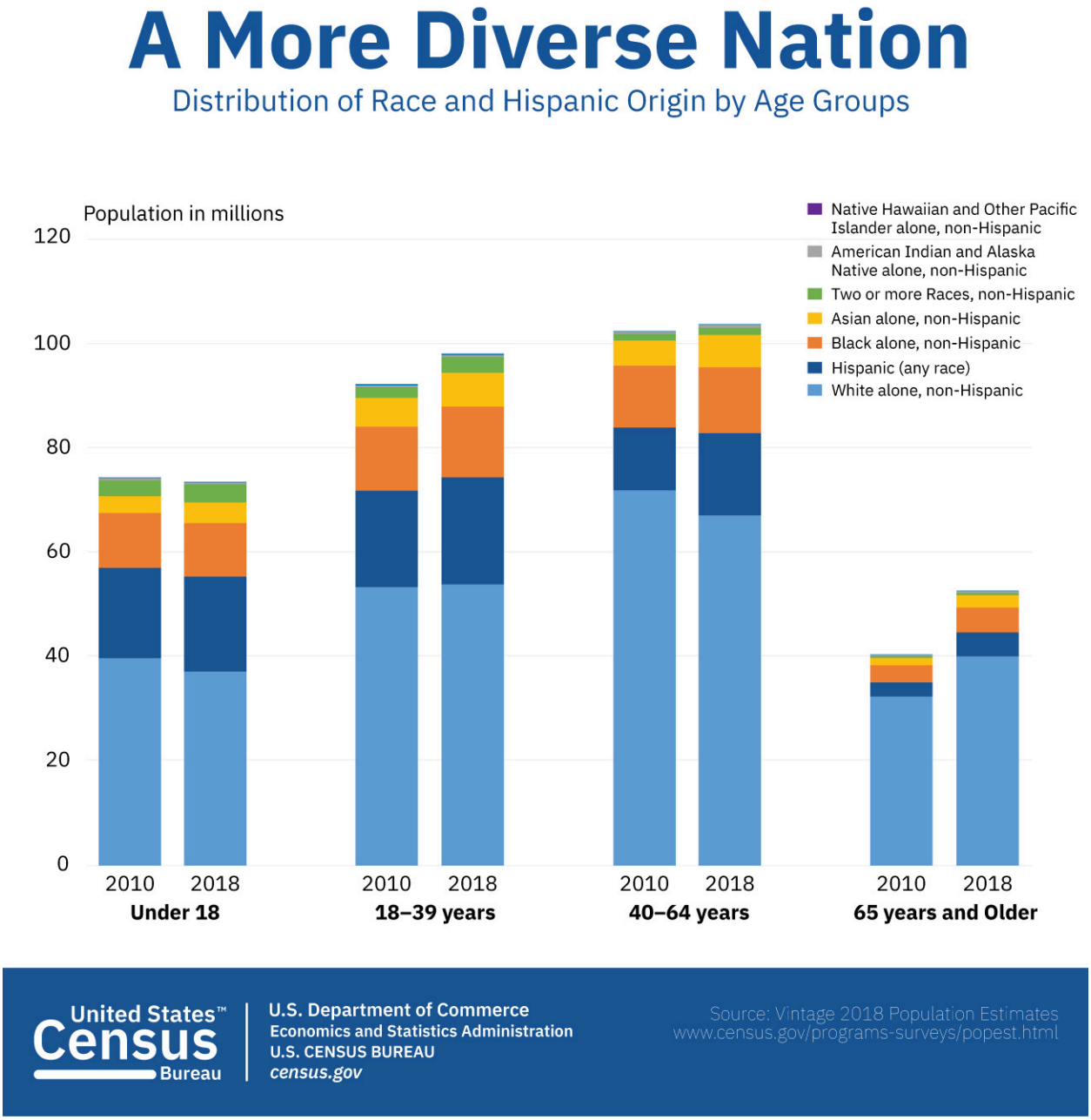

FIGURE 5.2 Census.gov tracks demographic data from year to year in the United States. This chart illustrates the increasing diversity of the nation across various age groups over time. (credit: "A More Diverse Nation" by US Census Bureau, Public Domain)

5.1 Understanding Cultural Differences

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify cultural influences on beliefs of health and illness
- Recognize health disparities among different cultures
- Describe different healers among cultural variations
- Explain how to counteract unconscious bias

Nurses encounter patients from a variety of backgrounds; therefore, it is essential they are able to provide culturally competent care. A lifelong process of applying evidence-based nursing in agreement with the cultural values, beliefs, worldview, and practices of patients to produce improved patient outcomes is known as **cultural competence**. It is a way of providing patient-centered, holistic nursing care.

A nurse who provides holistic care to patients will focus on healing the person as a whole rather than on one specific problem. In **holistic nursing care**, the interconnected aspects of a person's life, including their physical, cognitive, social, emotional, and spiritual health, are taken into account. In **culturally responsive care**, an individual's cultural beliefs are integrated into their health care. Culturally responsive care is required for a trusting, effective relationship with the patient.

Cultural Influences on Health and Illness

The United States is a nation characterized by a multitude of ethnic and cultural groups, with its diversity steadily increasing each day. A set of beliefs, attitudes, and practices shared by a group of people or community which is accepted, followed, and passed down to other members of the group is known as **culture**. Some groups of people have cultural beliefs that explain what causes illness, how illnesses are treated or cured, and who should be involved in the healing process. Culture also affects how people communicate with healthcare team members in terms of language or eye contact, or what can be discussed in terms of the person's body, health, or illness. A person's culture affects everything from how they think and feel about health and illness, to how receptive they are to treatment recommendations, to how, when, and from whom they receive care.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety and Procedure: Patient-Centered Care

Definition: Recognize the patient as a full partner in control of all decisions when providing compassionate and coordinated care based on respect for the patient's preferences, values, and needs.

Knowledge: Describe how diverse cultural, ethnic, and social backgrounds function as sources of patient, family, and community values.

Skill: Communicate patient values, preferences, and expressed needs to other members of the healthcare team.

Attitude: Respect and encourage individual expression of patient values, preferences, and expressed needs.

Best practice standards include the nurse providing competent, effective care with each patient interaction. Conducting a cultural assessment is one way to ensure the patient's preferences and cultural needs are met.

Physiological Differences

Some ethnic and cultural groups have a higher likelihood of experiencing specific diseases, particularly those with genetic conditions associated with their ancestry. Individuals belonging to these ancestral ethnicities are more prone to carrying recessive genes responsible for these illnesses. See Table 5.1 for a list of various ethnic groups along with some of the prevalent genetic diseases associated with each. For instance, there is potential susceptibility to certain cancers and rapid disease progression due to certain physiological diversity such as body structure, skin color, hair type, and metabolism (Perreira et al., 2019).

Ethnic Group(s)	Associated Hereditary Conditions
African	Sickle cell anemia, cystic fibrosis, thalassemia
Ashkenazi Jewish	Tay-Sachs disease, cystic fibrosis, Gaucher disease
Asian	Thalassemia
French Canadian, Cajun	Tay-Sachs disease
Mediterranean	Sickle cell anemia, thalassemia

TABLE 5.1 Ethnicities and Associated Hereditary Conditions

Psychological Differences

One main psychological distinction between cultures that affects how people think and make decisions is **individualism** versus **collectivism**. People from individualistic cultures focus on the individual. They are encouraged to make choices for their own benefit with an emphasis on independence and self-reliance, and health care tends to be viewed as a personal responsibility. Most Western countries, such as the United States, United Kingdom, and other parts of Western Europe are considered to have individualistic cultures (Fatehi et al., 2020).

In contrast, people from collectivistic cultures place an emphasis on community and cooperation. Decisions are made for the benefit of the collective. These cultures believe that it is best for society when everyone works together as a group, and the needs of the individual come secondary to the needs of the greater good. A patient from a collectivistic culture might entrust decisions about their treatment to their family, for example, reflecting the communal approach to decision-making and the importance of considering the broader impact on the group. Some countries that practice cultural collectivism include China, Japan, Indonesia, and some other Eastern countries.

Cultural Influences on Pain

Pain management can be a challenging task and can be made more complex by the cultural considerations particular to each patient. Pain is perceived differently across diverse cultures, including how to express it, how to treat it, and what it means. While pain is a universal physical sensation, its emotional and behavioral aspects are influenced by the cultural perspective of the individual (Givler & Bhatt, 2022). While each patient is an individual, and their response to pain should not be assumed based on their background, there are some broad tendencies in pain perception based on ethnicity. For instance, some research has shown that Black, Japanese, Hispanic, and East Asian cultures tend to be stoic about pain and may keep an unresponsive facial expression or believe that requesting pain medication is a sign of weakness. Others, such as those part of Muslim or Christian communities, can view pain as part of God's plan. Chinese patients may view pain as an imbalance between yin and yang (Perreira et al., 2019). This does not mean that that these groups do not experience pain. Avoiding misunderstandings related to cultural differences in perceptions of pain is crucial in preventing either overtreating or undertreating the patient's pain.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Culturally Sensitive Nursing Interventions for Pain

Even though the ways in which patients experience and express pain are influenced by their cultural background, pain is an individual experience. It is important for the nurse to be aware of cultural differences so they can treat the individual in a way that best suits their pain. Culturally sensitive nursing interventions for pain include the following (Givler & Bhatt, 2022):

- Providing an interpreter for patients with limited verbal or written English skills.
- Asking the patient about their ideas and understanding of the concept of pain. Their beliefs may be representative of their cultural background, or they may not—be careful not to generalize without listening to the patient.
- Providing thorough education to the patient on pain assessment and the importance of reporting pain. Self-reported assessments allow for a more accurate understanding of the patient's pain, taking into account their personal perception and experience.
- Assessing both observable behaviors and self-reported assessments to formulate a comprehensive approach to pain management. While observable behaviors can provide valuable insights into a patient's condition, they may not capture the full range of pain experiences. Some individuals may not express pain through observable behaviors, while others may exaggerate their discomfort.
- Being sensitive to traditional healing remedies, such as prayer or use of certain foods. Allow the patient to incorporate traditional remedies whenever possible. Make sure to gather a thorough history of all medicines, herbs, plants, and foods to avoid any possible interactions.
- Assuring the patient that the healthcare team is there to help treat their pain in a way that is the most appropriate and suitable for them.
- Adjusting the patient's care plan to reflect their cultural needs.

UNFOLDING CASE STUDY

Unfolding Case Study #1: Part 7

Refer to Chapter 3 Patient Communication and Interviewing and Chapter 4 Obtaining a Complete Health History for Unfolding Case Study Parts 1 through 6 to review the patient data. The medical-surgical nurse is providing care to a 28-year-old female patient who arrived to the hospital one hour ago from a walk-in medical clinic. The patient speaks only Spanish and is accompanied by her bilingual 10-year-old son.

Past Medical History	Patient is a mother of one, who cares for her child and older mother in a small apartment. The mother is homebound and is not present at the hospital. Patient cleans houses to support her family, but income is inconsistent. Patient has an eighth-grade education and speaks no English. Medical history includes seasonal allergies, sinusitis, and two episodes of COVID-19 in the past two years. **Family history:** Patient's father is deceased, and patient's mother has Alzheimer disease, stage II. Patient's son is in good health, talkative, and attentive to his mother. **Social history:** Patient is primary caregiver for mother and adolescent. No other support systems available. Patient has difficulty shopping and making doctor's appointments due to lack of care for mother. Patient has difficulty communicating in English, but son translates for his mother. **No current medications and no known allergies.**
Nursing Notes	**2310: Assessment** History and assessment is difficult to obtain because patient does not speak English. Son reports that patient was seen at the clinic for a cough and was diagnosed with pneumonia and started on medication for it. Patient remains on 2 L oxygen via nasal cannula, breathing pattern appears normal without distress.
Flow Chart	**2310: Assessment** Blood pressure: 135/75 mm Hg Heart rate: 97 beats/minute Respiratory rate: 22 breaths/minute Temperature: 100.1°F (37.2°C) Oxygen saturation: 97 percent on 2 L nasal cannula Pain: 9/10—ear
Lab Results	None
Diagnostic Tests/ Imaging Results	Chest x-ray: Bilateral infiltrates indicative of pneumonia. Sputum culture pending.
Provider's Orders	Close observation. Continue antibiotics. Wean off oxygen as tolerated.

1. Recognize cues: Which finding from the information provided is the highest priority at this time?
    a. patient does not speak English
    b. oxygen saturation 97 percent
    c. heart rate 97 beats/minute

d. sputum culture results

2. Analyze cues: The patient is reporting a 9/10 pain in the ear but does not show any other signs of being in pain such as grimacing or holding the ear. Which is the most likely rationale for this?
   a. The patient is lying about their pain level.
   b. The patient's pain has improved since getting to the hospital.
   c. The patient's culture may dictate how they show and process pain.
   d. The son stated the patient's pain was a 9/10 so she would get pain medicine more quickly.

Health Disparities Related to Cultural Differences

The **social determinant of health (SDOH)** are the economic, social, and environmental factors that influence an individual's health and well-being. The term **health disparity** describes the differences in health outcomes that result from SDOH. Various factors contribute to health disparities among various cultural groups. Socioeconomic class, race, educational level, and physical proximity to healthcare facilities are all factors related to health disparities. Black and American Indian populations have higher rates of obesity, diabetes, hypertension, and heart disease when compared to White populations (Perreira et al., 2019; National Academies of Sciences, Engineering, and Medicine, 2017a). Distrust of mainstream Western medicine in Black and American Indian communities due to a long history of systemic discrimination can further health disparities by preventing community members from seeking preventative care. This is another example of why it is important for the nurse to provide culturally sensitive care to all groups and foster a trusting relationship with the patient.

UNFOLDING CASE STUDY

Unfolding Case Study #1: Part 8

Refer back to Unfolding Case Study #1: Part 7 to review the patient data.

Nursing Notes	**0100:** Patient given one dose of acetaminophen and reports that ear pain is now 4/10. Interpreter has arrived and plans to stay on the unit until morning rounds so they can translate when the provider comes in. Patient resting comfortably, son sleeping on couch at the bedside.

3. Prioritize hypotheses: Based on the information provided in the patient's social history, the nurse is concerned that the patient may be experiencing health disparities. How are the social determinants of health linked to an increased risk of health disparities?
4. Generate solutions: What actions can the nurse take to address the social determinants of health that are contributing to the health disparities being experienced by the patient?

Healer Variations Among Different Cultures

Every culture develops its own ways of dealing with health and illness. The various medicines and healing practices around the world that differ from the modern, Western healthcare system are referred to as **traditional healing** (World Health Organization, n.d.) (Table 5.2). The term encompasses a vast range of traditions and practices that differ across diverse regions and cultures.

Traditional healing has long been used to promote health and fight disease and is still used today by many people around the world because traditional healers tend to be accessible, affordable, and knowledgeable of the language and culture. Some people rely on traditional healers instead of Western medicine, while others may choose to incorporate traditional healing practices into Western medical care.

Healing Tradition	Chief Characteristics
Traditional Chinese Medicine (TCM)	Belief in the idea of balance as the root of health; based in concepts of Qi and yin and yang; practices include acupuncture, cupping, herbs, tai chi
Ayurveda	Hindu form of medicine from India, based on idea that disease is caused by imbalance; seeks to cure imbalances using Ayurvedic medicine including diet, herbal medicines, yoga, and meditation
African Traditional Healing	Extremely diverse and varies by tribe; some many believe that ancestral spirits are closely involved in the lives of the living; offer spiritual education and care, and function as counselors and social workers
American Indian Traditions	Belief in spiritual and physical health as intertwined; the healer's role is to help the individual as they help themselves; ritual and ceremony have key roles in healing
Hispanic Traditions	Curanderismo is a holistic practice rooted in beliefs that health is achieved through the right balance of mind, body, and spirit; healers focus not only on the individual's physical health but also on their mental health, diet, personal relationships, and more; use various healing methods including prayer, oils, herbs, special diets, and other spiritual rituals
Western European Traditions	Role of patient at the center of the patient-healer relationship is crucial; strong foundation in using medicines created from natural elements, including herbs, plants, minerals, and animals

TABLE 5.2 Healing Traditions

Asian Traditions

Asian healing traditions are rooted in the concept of balance. Two of the more well-known traditions are Traditional Chinese Medicine and Ayurveda. Both Traditional Chinese Medicine and Ayurveda have become increasingly popular in recent years as complementary therapies to Western medicine.

Traditional Chinese Medicine (TCM) is an ancient practice based on the ideas of Qi and yin and yang. Qi is the life force that runs through one's body; yin and yang are the qualities of Qi that must be in balance for optimal health (Johns Hopkins Medicine, 2019b). TCM consists of such practices as acupuncture, acupressure, cupping, herbs, tai chi, and others (Figure 5.3). The Accreditation Commission for acupuncture and Oriental Medicine is a federally recognized organization that accredits schools in the United States that teach acupuncture and TCM.

FIGURE 5.3 Various herbs shown here are used in Traditional Chinese Medicine. (credit: "Chinese prescription," by Tim Wilson/Flickr, CC BY 2.0)

Ayurveda is a traditional Hindu form of medicine from India that is based on the idea that disease is caused by an imbalance in the body. Ayurvedic medicine seeks to cure this imbalance through a combination of diet, herbal medicines, yoga, and meditation. In India, Ayurvedic medicine is considered equivalent to conventional Western medicine, and providers receive formal training; however, there is no licensing process for Ayurvedic practitioners in the United States (Johns Hopkins Medicine, 2019a). Ayurvedic medicine consists of herbs, spices, minerals, and other substances that can interfere with conventional drugs (medications that are widely accepted and commonly used in mainstream medical practice); a thorough list of all medicines and supplements is an important part of the nursing assessment for this reason.

African Traditions

African healing traditions have their foundations in practices dating back thousands of years. Although specific religious traditions vary by tribe, traditional African healing is rooted in the idea that ancestral spirits are closely involved in the lives of the living and act as "mediators" between the living and God (Mokgobi, 2014). As Christianity and Islam began to spread across the continent, many people converted from traditional religions. However, they often retained traditional practices alongside embracing Westernized health care.

Healers vary among tribes; for example, the Bapedi tribe has diviners (*Ngaka ya ditaola*), Sanusi (or *Sedupe*), traditional surgeons, and traditional birth attendants. Diviners and Sanusi can diagnose and prescribe treatment for mental, physical, and spiritual afflictions (Zuma et al., 2016). Surgeons have been trained to perform circumcisions, along with the duties of diviners and Sanusi. Older women who have experience assisting with births over many years become traditional birth attendants. However, African traditional healers do more than help with physical illness and injury. They also offer spiritual education and care and have special knowledge of traditional culture, which allows them to function as counselors and social workers (Zuma et al., 2016).

American Indian Traditions

In American Indian and Alaska Native cultures, physical and spiritual health are interconnected. The belief is that in order for the body to heal, the soul must heal as well. American Indian healers believe the individual is the source of most of the healing and is responsible for their own health, wellness, and behavior. The healer's role is to help the individual as they heal themselves, although the individual's family and community play an important part as well (National Institutes of Health [NIH], n.d.).

Ritual and ceremony hold a key role in traditional American Indian healing. Purifying and cleansing the body, whether through sweating or purging, is an important practice in some American Indian healing rituals. Smudging is another practice that involves cleansing a place or person with the smoke of certain sacred plants. Some healing ceremonies can involve whole communities. These ceremonies can include music, painting bodies, dancing, exorcisms, sand paintings, stories, and use of mind-altering substances. These ceremonies are a way to seek spiritual assistance and physical healing (NIH, n.d.).

Members of the Native American Church are legally allowed to use peyote, a hallucinogen, during religious ceremonies. It can cause hallucinations and alterations in perceptions of space, time, and self. Physical symptoms include nausea, vomiting, dilated pupils, increased heart rate, elevated blood pressure, perspiration, headaches, muscle weakness, and impaired motor coordination. In rare cases, large doses have been reported to cause bradycardia, hypotension, and respiratory depression (Department of Justice, 2020). Peyote has been used for centuries by American Indians and is considered a sacred plant.

LINK TO LEARNING

This video from the Harvard Divinity School features a discussion with Native American Church leaders about the Sacrament of Peyote (https://openstax.org/r/77peyote) and its history in the Indigenous medicine world.

Hispanic Traditions

Traditional Hispanic medicine is known as curanderismo**,** with the healers called *curandera* (women) or *curandero* (men). The holistic practice of **curanderismo** is rooted in beliefs that health is achieved through the right balance of mind, body, and spirit. A curandero focuses not only on the individual's physical health but also on their mental health, diet, personal relationships, and more. Curanderos use various healing methods including prayer, oils, herbs, special diets, and other spiritual rituals. They also act as counselors and social workers, listening to individuals talk about their problems and helping them build an emotional support network (Cruz et al., 2022).

Western European Traditions

The central role of the patient in the healer/patient relationship is foundational to modern Western European healing culture. There is also a strong emphasis on technology and scientific evidence of healing practices.

Traditional European medicine has a strong foundation in using medicines created from natural elements, including herbs, plants, minerals, and animals (Firenzuoli & Gori, 2007; Hosseinzadeh et al., 2015). Homeopathy (an alternative medicine system based on the principle of "like cures like," utilizing highly diluted substances to treat similar symptoms) and naturopathy (focusing on the body's self-healing abilities through holistic approaches like dietary changes, herbal medicine, and lifestyle counseling) both have roots in European tradition. Individuals who rely on herbal and plant-based remedies tend to either use them in conjunction with conventional Western medicine or view them as alternatives to harsher methods of treatment. Examples of these remedies are discussed later in this chapter, in 5.3 Cultural Practice in Nursing. Nurses should provide quality education to their patients about clinical evidence of the effectiveness of these complementary and alternative therapies (Leonti & Verpoorte, 2017).

Counteracting Implicit Bias

Everyone holds biases that reflect their own personal belief systems. An **explicit bias** is a consciously held set of beliefs about a person, situation, or group based on certain characteristics (Sabin, 2022). Explicit bias is what we typically think of when we see or hear the word *bias*. A person might be openly biased against someone due to their age, gender, race, sexuality, or another reason. An overtly racist comment is an example of explicit bias (Sabin, 2022).

In comparison, **implicit bias** refers to all our unconscious biases. Implicit bias is an automatic reaction toward a person, situation, or group involving subconscious feelings, perceptions, attitudes, and stereotypes. You may hold conscious beliefs about equality and fairness while still having unconscious, implicit biases that contradict these beliefs.

Bias negatively affects the patient-provider relationship, leading to poorer quality care and worse outcomes for certain groups. For example, research studies have shown that implicit bias regularly leads to the undertreatment of pain in Black patients (Sabin, 2022). Implicit bias can be difficult to change because it operates at an unconscious level, making individuals often unaware of these biases. The first step in overcoming implicit biases is to become aware of them; training in diversity and inclusiveness can also help identify problematic feelings, thoughts, and behaviors.

LINK TO LEARNING

Learn more about your own implicit biases (https://openstax.org/r/77implbiases) by taking this available test.

5.2 Ethical Practice in Culture and Diversity

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify ways to accommodate different cultural practices
- Explain ethical ways to engage in cultural diversity practices
- Define how nurses can be responsive to diversity and inclusion

As discussed in 5.1 Understanding Cultural Differences, the concept of culturally responsive care, which involves integrating an individual's cultural beliefs into their health care, is an important foundation of cultural competence. Providing culturally competent care requires attention to diversity and inclusion and a willingness to understand and accommodate the cultural differences of others. According to the American Psychological Association (APA) (n.d.), cultural diversity is "the existence of societies, communities, or subcultures that differ substantially from one another." And, **inclusion** is "the practice of creating an environment in which individuals of all backgrounds feel respected, valued, and supported."

According to the Centers for Disease Control and Prevention (CDC) (2021), there are eight principles of cultural competence:

1. Define culture broadly.
2. Value patients' cultural beliefs.
3. Recognize complexity in language interpretation.
4. Facilitate learning between providers and communities.
5. Involve the community in defining and addressing service needs.
6. Collaborate with other agencies.
7. Professionalize staff hiring and training.
8. Institutionalize cultural competence.

Note that it is the responsibility of the healthcare professional to seek out, understand, and integrate the patient's beliefs into their care. Ultimately, the goal is to build cultural competence into the permanent framework of health care.

Accommodating Cultural Practices

According to the American Nurses Association (ANA) Code of Ethics (2015), nurses must practice with cultural humility and inclusiveness. Culture is constantly evolving, so true cultural competence requires a lifetime of learning with these changes. The ANA defines **cultural humility** as "a humble and respectful attitude toward individuals of other cultures that pushes one to challenge their own cultural biases, realize they cannot know everything about other cultures, and approach learning about other cultures as a life-long goal and process."

There are both intrapersonal and interpersonal components to cultural humility (Table 5.3) (Hughes et al., 2020).

The **intrapersonal** component consists of a personal awareness of one's own limited knowledge of the patient's culture. The **interpersonal** component involves respect for the patient's culture and openness to their beliefs and experiences. By focusing on developing partnerships with patients, the nurse can create a space that encourages learning and appreciation for diverse cultures. It is a patient-centered way of providing culturally sensitive care.

Interpersonal Skills	Intrapersonal Skills
Involves relations between people	Occurs within the individual mind or self
Two or more parties involved	No external parties involved
Feedback comes from the parties involved	Feedback comes in the form of self-analysis
Important to building and maintaining relationships; must develop self-awareness	Continuous flow of thought; ones' own thoughts, views, opinions, and attitudes are developed

TABLE 5.3 Interpersonal versus Intrapersonal Skills

Avoid Forcing Change

Cultural humility involves inclusion. Inclusion means considering the patient's own cultural preferences and involving the patient and caregivers in the process as much as possible. Forcing a patient to accept a treatment plan that conflicts with their cultural practices and beliefs is rarely effective and can damage the relationship of trust between the nurse and the patient. A **cultural negotiation** is a process by which the patient and nurse seek a mutually acceptable way to deal with competing interests of nursing care, prescribed medical care, and the patient's cultural needs. Cultural negotiation is reciprocal and collaborative. When the patient's cultural needs do not significantly or adversely affect their treatment plan, the cultural needs can and should be accommodated.

Seek Cultural Assistance

Having respectful, curious, in-depth conversations with patients is the best way to learn about their individual cultural practices. When seeking ways to accommodate diverse cultural practices, approach patients with cultural humility to learn how best to care for the patient. Cultural guides from various local communities may also be available for cultural dialogue (Substance Abuse and Mental Health Services Administration [SAMHSA], 2014). Collaboration between patients from diverse cultures and nurses is an excellent way to produce culturally sensitive, patient-centered care plans (Hughes et al., 2020). Examples of seeking cultural assistance include exploring programs and initiatives that may be offered by various organizations, discovering available resources, or developing initiatives for unit-based councils.

Engagement in Cultural Diversity

As a nurse, it is necessary to actively engage with the patient and their culture to foster cultural competence, build trust, and tailor healthcare services to individual needs. This approach ensures a patient-centered, inclusive, and holistic approach to health care. Cultural negotiation is mutual; the nurse and the patient must gain an understanding of each other's perspective. There are many ways a nurse can actively participate in learning about various cultures to best serve diverse patient populations. Some examples include encouraging the patient to bring food from home and involving the family in medical decision-making.

Active Learning

One of the first steps in engaging in cultural diversity is to get to know your community—what ethnic groups are most prevalent, what languages are most widely spoken, what religions are most popular? Use sources such as newspapers, journal or book articles, and cultural training seminars or courses to research cultural issues that are relevant to your area. However, it is important to remember not to stereotype or generalize patients. Make sure to ask each patient about their personal preferences when it comes to their cultural background and beliefs (Stubbe, 2020).

Learning about cultural diversity also includes becoming aware of your own practices and implicit biases. There are various implicit bias tests available to help you identify unconsciously held beliefs. Journaling is another way to help

identify and reflect on personal thoughts and feelings toward working with diverse groups.

Awareness of your own practices can help identify and address issues with practices observed in the workplace. For example, your area may have a large Arabic-speaking population, but your clinic does not have consent forms in Arabic. You decide to advocate for your patients and ask the clinic to provide consent forms in Arabic. Another example would be your clinic hosts educational workshops so employees can actively learn about the populations they serve. Learning about the culture of your patient population leads to better patient outcomes and often greater job satisfaction.

Exploring

Immersing yourself in diverse cultural communities can be an engaging and fun way to learn more about cultural diversity. Attending local cultural events such as festivals and dances, exploring art and music scenes, and even joining religious ceremonies (special permission may be needed) are all ways to experience cultural practices firsthand (Figure 5.4).

FIGURE 5.4 Attending cultural festivals, like the annual Carnival celebration of Mardi Gras in Louisiana, is an excellent way to gain firsthand exposure to diverse cultural practices. (credit: "Fat Tuesday_Mardi Gras Indians_4," by Derek Bridges/Flickr, CC BY 2.0)

Responsiveness to Cultural Diversity

Learning about diverse cultures is only one step toward providing culturally competent care. How one responds to cultural diversity is what directly affects the nurse-patient relationship and outcomes. According to the U.S. Department of Health and Human Services (HHS, n.d.), "being culturally responsive requires having the ability to understand cultural differences, recognize potential biases, and look beyond differences to work productively with children, families, and communities whose cultural contexts are different from one's own." Being responsive to cultural diversity involves taking what you have learned about other cultures from conversations, experiences, and research and integrating the knowledge into your practice. It also involves advocating for diversity and inclusion at a structural and institutional level.

Willingness to Change

Approach the process of learning about diverse cultures with cultural humility. To understand various cultures, one must engage in self-reflection and remain open to new ideas, beliefs, and behaviors. It is normal to encounter beliefs and practices that are different from your own. They may be in direct conflict with your own cultural background and may even make you uncomfortable, sad, angry, or confused. It is not expected that you will completely change all your thoughts and feelings, but a *willingness* to change is key to accepting others and putting cultural competence into action.

REAL RN STORIES

Recognition of Cultural Biases

Nurse: Jenny, RN
Clinical setting: Medical-surgical unit
Years in practice: 2
Facility location: Southern California

At 28 years old, I relocated from Florida to southern California. I am White, and until this point, I had spent my entire life living in Florida. I had been practicing nursing for two years and had just started a new job on a medical-surgical floor at a local hospital. The hospital was located in a community that was known for its large Vietnamese population. Most of the nurses, providers, and patients at the hospital were either Vietnamese immigrants or of Vietnamese descent.

One day I took report on a new patient, a 53-year-old Vietnamese female with a diagnosis of terminal brain cancer. The patient was not expected to survive; however she remained a full code, and the family was refusing hospice (end-of-life care focused on increasing comfort and managing pain). I wondered why the patient and family would refuse hospice care.

As I went to assess the patient, I found her lying in bed and moaning while clutching her head in her hands. She was nonverbal and nonresponsive to my stimuli. I noticed she had an order for pain medication, so I administered it as ordered.

Upon reassessing her, I noticed the medication did not seem to make much difference in the observable behaviors. The patient was still clutching her head in her hands and moaning. The doctor refused to increase the dose at my suggestion and seemed to brush me off when I recommended talking to the family again about comfort measures. I found myself growing increasingly frustrated on behalf of my patient, and I felt she might be suffering unnecessarily at the end of her life.

At lunch, I called the patient's daughter, Viv, and requested she come to the hospital to visit her mother. Upon the daughter's arrival, I had just given the patient some IV pain medication, but the patient was not responding or showing signs of relief. Viv stated, "The pain medication does not seem to be making much of a difference the last couple of days." I asked her if she had considered hospice for her mother and explained that I had found hospice very helpful when my own grandmother was at the end of her life. Viv told me that she had discussed hospice with the physicians but decided against it. "Hospice is not an option for us. In our culture, we believe in fighting with everything we have down to the last minute," she stated. She explained that she and her family viewed the use of medication at end-of-life in hospice care as hastening death.

After having this conversation with Viv, I had a new understanding of why the family was refusing hospice and comfort measures. I now understood how important it was to the patient and the patient's family that their own views on end-of-life care be respected. This conversation allowed me to reexamine my own cultural biases and be more culturally respectful of the patients I was now serving.

5.3 Cultural Practice in Nursing

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the guidelines for nursing care of different cultural practices
- Explain the importance of cultural competency in nursing
- Recognize factors that can affect diversity and inclusion in nursing

The importance of cultural competence cannot be understated. Cultural competence enables a nurse to deliver the highest quality, safest, and most patient-centered care possible. Establishing a culturally sensitive environment is the first step in providing culturally responsive care to patients. An accurate and thorough cultural assessment allows for the gathering of patient-specific cultural information. The pursuit of culturally competent care also requires recognizing the various factors that can affect diversity and inclusion in nursing.

Guidelines for Nursing Care

Providing culturally responsive care integrates an individual's cultural beliefs into their health care. Begin by conveying cultural sensitivity to patients and their family members with these suggestions:

- Set the stage by introducing yourself by name and role when meeting the patient and their family for the first time. Until you know differently, address the patient formally by using their title and last name. Ask the patient how they wish to be addressed and record this in the patient's chart. Respectfully acknowledge any family members and visitors at the patient's bedside.
- Begin by standing or sitting at least arm's length from the patient.
- Observe the patient and family members in regard to eye contact, space orientation, touch, and other nonverbal communication behaviors and follow their lead.
- Make note of the language the patient prefers to use and record this in the patient's chart. If English is not the patient's primary language, determine if a medical interpreter is required before proceeding with interview questions.
- Use inclusive language that is culturally sensitive and appropriate. For example, do not refer to someone as "wheelchair bound"; instead say "a person who uses a wheelchair."
- Be open and honest about the extent of your knowledge of their culture. It is acceptable to politely ask questions about their beliefs and seek clarification to avoid misunderstandings.
- Adopt a nonjudgmental approach and show respect for the patient's cultural beliefs, values, and practices. It is possible that you may not agree with a patient's cultural expressions, but it is imperative that the patient's rights are upheld. As long as the expressions are not unsafe for the patient or others, the nurse should attempt to integrate them into their care.
- Assure the patient that their cultural considerations are a priority of their care.

Cultural Assessment

After establishing a culturally sensitive environment, nurses should incorporate a cultural assessment when caring for all patients. There are many assessment guides used for patient interviews that are adaptable to a variety of healthcare settings and are designed to facilitate understanding and communication.

The Four Cs of Culture model is an example of a quick cultural assessment tool that asks questions about what the patient **C**onsiders to be a problem, the **C**ause of the problem, how they are **C**oping with the problem, and how **C**oncerned they are about the problem. Use these questions based on the Four Cs model in nurse-patient conversations to conduct a cultural assessment:

1. What do you think is wrong? What is worrying you? (In other words, discover what the patient **C**onsiders to be the problem and what they call it.)
    - Example: A patient with a diagnosis of a sinus infection believes their body is "unbalanced."
2. What do you think **C**aused this problem? How did this happen?
    - Example: The patient believes this illness is a punishment for a misdeed.
3. What are you doing to **C**ope with this problem? How are you taking care of yourself?
    - Example: The patient avoids eating certain foods to treat the illness while also using home remedies such as herbal tea.
4. How serious is this problem for you? How **C**oncerned are you?
    - Example: A patient views the illness as being "God's will" and states, "It's in God's hands."

PATIENT CONVERSATIONS

How Do You Perform a Brief Cultural Assessment?

Scenario: The nurse enters the patient's room to perform a cultural assessment. The patient is a woman from China who is visiting family in the area and prefers to speak Mandarin. The nurse sets up the video translator to begin the conversation and introduces the translator to the patient.

Nurse: Hi, I'm Travis, and I'm going to be your nurse today. Can you please tell me your name and date of birth?

Patient: Mei Wang, January 2, 1947.

Nurse: What would like for me to call you?

Patient: Mrs. Wang is fine.

Nurse: Mrs. Wang, I'm here to do a cultural assessment, which involves asking you a few questions. It should take less than 15 minutes. Is that okay?

Patient: Yes, that is fine.

Nurse: What do you think is wrong? What is worrying you?

Patient: The doctors are telling me that I have an infection in my lungs. I haven't been feeling well, and I believe it is because my body is not in balance.

Nurse: What do you think caused this problem? How did this happen?

Patient: My husband died four months ago, and I left China to live with my son and his family here in the United States. I miss my husband, and everything here is so different compared to what I'm used to.

Nurse: Have you been trying things at home to make yourself feel better? How have you been coping?

Patient: I've been making some special food. A lot of soup, and other foods with ginger, onion, garlic to help with the phlegm.

Nurse: How serious is this problem for you? How concerned are you?

Patient: I've never been in the hospital before, so I'm worried, but I think the doctors are good here and will get me home. I want to make sure that my family can bring me food from home, though. I don't like the hospital food, my food from home is much better for me.

Nurse: I'll check with your doctor to see if your family can bring your food from home; I'll tell them how much better you like it, okay? My assessment is done for now, do you have any other questions for me?

Patient: Not right now, thank you for talking to me.

Another, more comprehensive cultural assessment tool, inspired by R. E. Spector's Heritage Assessment Interview, is called the Sample Cultural Assessment Interview and includes these additional questions:

- Where were you born? Where were your parents born?
- What pronoun do you use (he, she, they)?
- In what language are you most comfortable speaking and reading?
- Did you grow up in a city or a town or a rural setting?

UNFOLDING CASE STUDY

Unfolding Case Study #1: Part 9

Refer back to Unfolding Case Study #1: Part 7 to review the patient data.

Nursing Notes	**0700: Assessment** Patient is awake and alert and reports feeling "much better." Patient reports anxiety about finances and is worried about being able to feed her family. She states that she makes enough each month to get by, but her mother is getting older and beginning to require more care and medications.
Flow Chart	**0700: Assessment** Blood pressure: 128/72 mm Hg Heart rate: 87 beats/minute Respiratory rate: 18 breaths/minute Temperature: 99.1°F Oxygen saturation: 97 percent on room air
Provider's Orders	Discharge after meeting with social worker.

5. Take action: As part of the assessment, the nurse also conducts a cultural assessment. How would the nurse use the Four Cs of Culture model to conduct the assessment on this patient?
6. Evaluate outcomes: How would you determine that the patient's social needs have been addressed sufficiently before discharge home?

Cultural Knowledge

Acquiring cultural knowledge is another important step toward becoming a culturally competent nurse. The term **cultural knowledge** refers to seeking information about cultural health beliefs, history, customs, and values to understand patients' worldviews. To acquire cultural knowledge, the nurse actively seeks information about other cultures, including common practices, beliefs, values, and customs, particularly for those cultures that are prevalent within the communities they serve. Cultural knowledge also includes understanding the historical backgrounds of culturally diverse groups in society, as well as physiological variations and the incidence of certain health conditions in culturally diverse groups. Cultural knowledge is best obtained through cultural encounters with patients from diverse backgrounds to learn about individual variations that occur within cultural groups and to prevent stereotyping.

Standards of Practice

The Transcultural Nursing Society has developed Standards of Practice for Culturally Competent Nursing Care (Douglas et al., 2011). These twelve standards are intended to serve as a universally applicable guide for nurses in all aspects of culturally competent nursing care:

1. Social justice: Nurses must promote and advocate for social justice for all.
2. Critical reflection: Nurses must engage in ongoing, personal, critical reflection of how their cultural beliefs and practices affect their nursing care.
3. Knowledge of cultures: Nurses must understand diverse cultures and factors that affect health and well-being.
4. Culturally competent practice: Nurses must use cross-cultural knowledge and skills in implementing culturally competent nursing care.
5. Cultural competence in healthcare systems and organizations: Healthcare institutions must provide the structure and resources necessary to meet the needs of their culturally diverse patients.
6. Patient advocacy and empowerment: Nurses must empower their patients to navigate the healthcare system and advocate for inclusion of the patient's cultural beliefs in their health care.
7. Multicultural workforce: Nurses must actively work toward having a multicultural workforce in healthcare settings.
8. Education and training in culturally competent care: Nurses must be educationally prepared to promote and provide culturally congruent health care through formal education, clinical training, and continuing education for practicing nurses.

9. Cross-cultural communication: Nurses must use culturally competent communication skills when providing patient care.
10. Cross-cultural leadership: Nurses must strive to influence others to achieve culturally competent care for diverse groups.
11. Policy development: Nurses must work to establish policies and standards for culturally competent care.
12. Evidence-based practice and research: Nurses must base their practice on interventions that have been shown to be effective through evidence-based practice.

Complementary and Alternative Therapies

Nonmainstream approaches to health that are used alongside conventional Western medical care are called **complementary therapies**. When nonmainstream approaches are used in place of conventional Western medical care, they are called **alternative therapies** (U.S. Department of Health and Human Services [HHS], n.d.a). Conventional therapies are more common than alternative therapies in the United States. Examples of therapies that may be used for complementary or alternative purposes include the use of melatonin for insomnia or acupuncture for muscle pain. It is important for the nurse to perform a thorough medication reconciliation so that complementary or alternative therapies are not missed. Patients may not consider these supplements as "medicines" or "drugs."

Nutritional/Supplemental Therapies

Nutritional and supplemental therapies involve the use of dietary approaches and supplements to enhance well-being and address health issues. Dietary supplements, such as vitamins and minerals, are taken to supplement the diet and ensure adequate nutrient intake. Herbal supplements, derived from plants, are believed to have medicinal properties. Probiotics, which are beneficial bacteria that promote gut health, are commonly used as supplements. Fish oil supplements, rich in omega-3 fatty acids, are believed to have cardiovascular benefits. It is crucial for individuals considering these approaches to consult with healthcare professionals to ensure they align with their specific health needs and do not interfere with any existing medical treatments. As these products can interact with drugs, it is important to get a comprehensive list from the patient of all supplements they are taking. For example, St. John's Wort, a common supplement, is known to interact with numerous different common medications including selective serotonin reuptake inhibitors, certain contraceptives, and digoxin (Mayo Foundation, 2021).

Physical and Psychological Therapies

Physical and psychological therapies include a wide range of modalities, such as acupuncture, massage therapy, meditation, reiki (a Japanese healing technique that involves the transfer of energy through the practitioner's hands to promote physical and emotional healing), and qigong (a Chinese practice that combines breath control, gentle movement, and meditation to cultivate and balance the body's vital energy). Cupping, coining (a traditional East Asian healing technique that involves scraping the skin with a smooth-edged tool, such as a coin or spoon, to promote blood flow and release tension), yoga, art, music, and dance also fall into this category. Acupuncture and cupping are two of the more popular alternative and complementary physical therapy modalities. Acupuncture is used to treat pain and multiple other conditions; it is performed by inserting needles at special points in the body. Acupuncture is intended to restore balance and is thought to work by releasing endorphins, the body's natural painkillers. Cupping is another traditional therapy where cups are placed on the skin to increase blood flow with the aim of helping with stress or muscle aches and pains (see Figure 5.5).

FIGURE 5.5 Blood marks such as these are a normal finding on someone after a cupping session. (credit: "Cupping," by Renato Ganoza/ Flickr, CC BY 2.0)

Other Complementary Therapies

There are other complementary therapies that do not fit in either category. These include traditional healers, Ayurvedic medicine, TCM, naturopathy, and homeopathy. Derived from eighteenth- and nineteenth-century European natural healing systems, naturopathy involves a combination of therapies including herbal medicine, diet, acupuncture, and psychotherapy (HHS, 2017). In homeopathy, natural products are used in highly diluted doses to treat illness. Examples include *Arnica montana*, often used for muscle soreness and injuries, or chamomilla, often used for colic, teething, and childhood irritability. Homeopathic products can still include ingredients that can cause significant drug interactions, so they must be noted on the patient's chart (HHS, n.d.b).

Cultural Competency

The freedom to express one's cultural beliefs is a fundamental right of all people. Nurses realize that people speak, behave, and act in many different ways due to the influential role that culture plays in their lives and their view of the world. Cultural competence is a lifelong process of applying evidence-based nursing in agreement with the cultural values, beliefs, worldview, and practices of patients to produce improved patient outcomes.

Culturally competent care requires nurses to combine their knowledge and skills with awareness, curiosity, and sensitivity about their patients' cultural beliefs. It takes motivation, time, and practice to develop cultural competence, and it will evolve throughout your nursing career. Culturally competent nurses have the power to improve the quality of care leading to better health outcomes for culturally diverse patients. Nurses who accept and uphold the cultural values and beliefs of their patients are more likely to develop supportive and trusting relationships with their patients. In turn, this opens the way for optimal disease and injury prevention and leads toward positive health outcomes for all patients.

LINK TO LEARNING

A unique and inspiring discussion about becoming a culturally competent nurse (https://openstax.org/r/77cultcomp) is presented in this video.

Transcultural Nursing

The roots of providing culturally competent care are based on the original transcultural nursing concept developed by nurse and anthropologist, Madeleine Leininger. In **transcultural nursing**, care incorporates the cultural beliefs and practices of individuals to help them maintain and regain health or face death in a meaningful way. It forms the basis of all culturally competent care.

Theory of Cultural Care Diversity

Leininger's Theory of Culture Care: Diversity and Universality is also known as the **Culture Care Theory (CCT)**. It

provides the framework for transcultural nursing and the development and practice of culturally competent nursing care (McFarland & Wehbe-Alamah, 2019). Leininger states that health care cannot be effectively provided without considering the patient's cultural background. The theory emphasizes the importance of understanding the cultural values, beliefs, and practices of patients in order to provide appropriate care. According to Leininger, culture is a fundamental component of human life and influences an individual's perception of health, illness, and health care (McFarland & Wehbe-Alamah, 2019). Therefore, healthcare providers must approach each patient with cultural sensitivity and strive to deliver care that is respectful and tailored to the patient's cultural needs. The CCT is an important framework for promoting culturally competent care and achieving health equity for all individuals. Using the CCT as a framework, nurses can guide research of discovery and translational research projects for evidenced-based nursing practice. Educational programs can develop nursing courses and curricula to prepare culturally competent nurses. Hospitals and medical facilities can use the framework to guide future culturally competent administrative and leadership policies and procedures.

Factors Affecting Diversity and Inclusion in Nursing

The ANA recognizes specific factors that negatively affect diversity and inclusion in nursing. Explicit bias in the form of discrimination due to gender identity, race, ethnicity, sexual orientation, or socioeconomic status negatively impacts the health status of various populations. Implicit bias affects the relationship between healthcare providers and patients, as well as outcomes, even though it is unintentional (Jolley & Peck, 2022). Awareness of one's biases is always the first step in combating them.

Cultural Self-Awareness

A person's understanding of their own culture and its impact on self is referred to as **cultural self-awareness**. Understanding self is a crucial step in forming a broader understanding and acceptance of other cultures (Lu & Wan, 2018). To develop cultural awareness, people can educate themselves about diverse cultures, learn to recognize and avoid stereotypes, and engage in cross-cultural communication and interaction. It is important to note that cultural awareness is not a one-time achievement but an ongoing process that requires continuous learning and adaptation. Cultural self-awareness can help us understand what shapes our own values and beliefs and recognize our place in a larger multicultural society.

Ethnocentrism

The belief that one's culture (or race, ethnicity, or country) is better than and preferable to another's culture is termed **ethnocentrism**. An example would be a nurse telling a patient that conventional Western medical treatments are better than traditional healing remedies. Appropriate cultural self-awareness can help the nurse avoid ethnocentrism. Designing interventions that are relevant to and respectful of the patient's culture is one way to avoid ethnocentrism. Other ways to avoid ethnocentrism include avoiding generalizations or stereotypes about diverse cultures. Approach cultural differences with an open mind, a readiness to learn and understand, and a willingness to consistently engage in each patient interaction with cultural humility and active-listening.

Six Cultural Phenomena

There are other cultural considerations that can affect efforts to increase diversity and inclusion in nursing, which Giger and Davidhizar identify in their Transcultural Assessment Model (2002). The Transcultural Assessment Model was developed as a way for nurses to assess and provide care for culturally diverse patients. This model states that each individual is unique and should be assessed according to six cultural phenomena:

- Communication: This includes the language, tone, and nonverbal cues used by the individual and the healthcare provider. Communication styles can vary across cultures and can impact the effectiveness of healthcare interactions.
- Personal space: All communication occurs in the context of space. There are four distinct zones of interpersonal space intimate, personal, social/consultative, and public (Figure 5.6) (Hall, 1966). This includes the physical and emotional distance between the individual and the healthcare provider. Cultural norms around personal space and touch can vary across cultures.

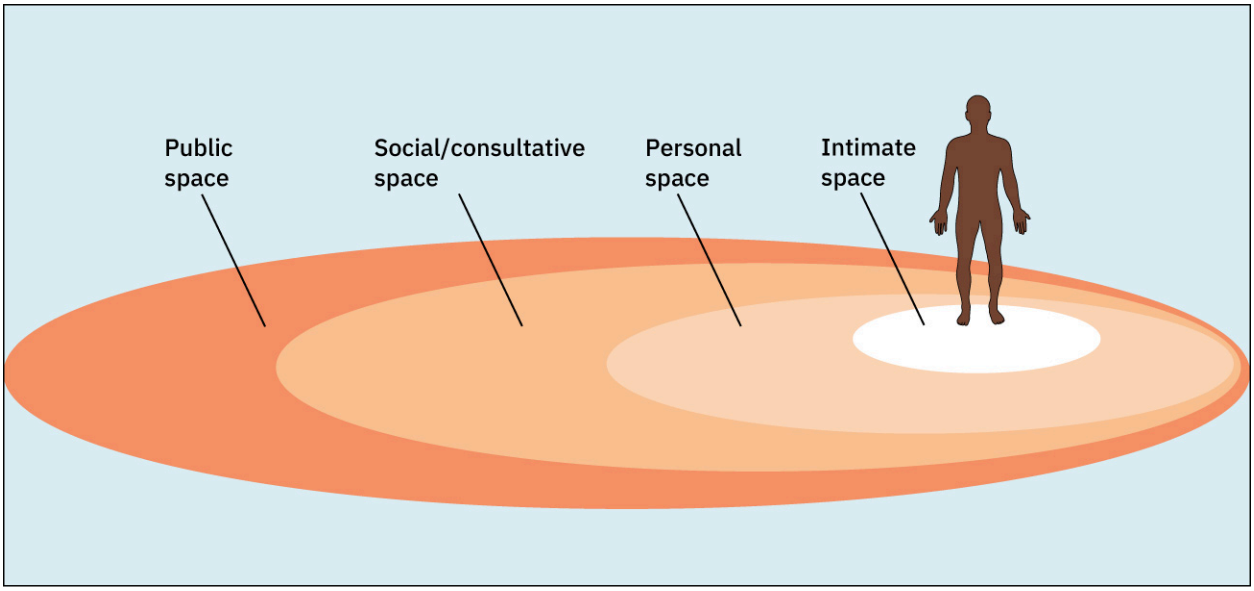

FIGURE 5.6 There are four zones of interpersonal space that vary depending on cultural norms. How much space is acceptable varies across cultures. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

- Social organization: This includes the individual's cultural values and beliefs related to family, community, and social roles. Cultural expectations around family involvement in healthcare decisions, for example, can vary across cultures. Another example is local, state, or government agencies that all share the same values, beliefs, and interests.
- Time orientation: Time is an important aspect of interpersonal communication. This includes the individual's cultural beliefs and practices related to time, such as punctuality and the perception of time as linear or cyclical. For example, the past, present, and future have different meanings and value to different cultures.
- Environmental control: This includes the individual's cultural beliefs and practices related to controlling their environment, such as beliefs around the causes of illness and how it is directly impacted by one's environment.
- Biologic variations: This includes the individual's cultural beliefs and practices related to biology, such as beliefs around the causes of illness and the use of alternative therapies. Cultural beliefs around pain management and the use of medication can also vary across cultures.

CULTURAL CONTEXT

Patients and Personal Space

The amount of space that a person surrounds themself with to feel comfortable is influenced by culture. For example, for some people, it would feel awkward to stand four inches away from another person while holding a social conversation, but for others a small personal space is expected when conversing with another. There are times when a nurse must enter a patient's personal space, which can cause emotional distress for some patients. The nurse should always ask for permission before entering a patient's personal space and explain why and what is about to happen.

Patients may also be concerned about their modesty or being exposed. A patient may deal with the violation of their space by removing themselves from the situation, pulling away, or closing their eyes. The nurse should recognize these cues for what they are, an expression of cultural preference, and allow the patient to assume a position or distance that is comfortable for them.

Similar to cultural influences on personal space, touch is also culturally determined. This has implications for nurses because it may be inappropriate for a male nurse to provide care for a female patient and vice versa. In some cultures, it is also considered rude to touch a person's head without permission.

5.4 Diversity, Equity, and Inclusion

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Define important considerations related to providing equal, diverse, and inclusive nursing care
- Identify factors that can prevent diversity and inclusion
- Explain how barriers to communication affect diversity and inclusion

Diversity and inclusion create an environment that encourages different ideas, cultures, backgrounds, and experiences. This type of environment allows nurses to provide more comprehensive and effective care to their patients. Diversity, equality, and inclusion foster a culture of mutual respect, understanding, and support which can lead to improved patient outcomes. Additionally, diversity and inclusion can help to reduce health disparities which can improve healthcare access and quality for communities that are traditionally underserved. Ultimately, diversity and inclusion are critical components of successful nursing practice that can help to ensure that all patients receive the best possible care.

Equality

The principle of ensuring that all individuals, regardless of their background or socioeconomic status, have equal access to healthcare resources and opportunities is called **health equality** (CDC, 2022b). When everyone has a fair opportunity to obtain optimal health, **health equity** is achieved (CDC, 2022a). Both equity and equality are important considerations when providing inclusive nursing care (Figure 5.7).

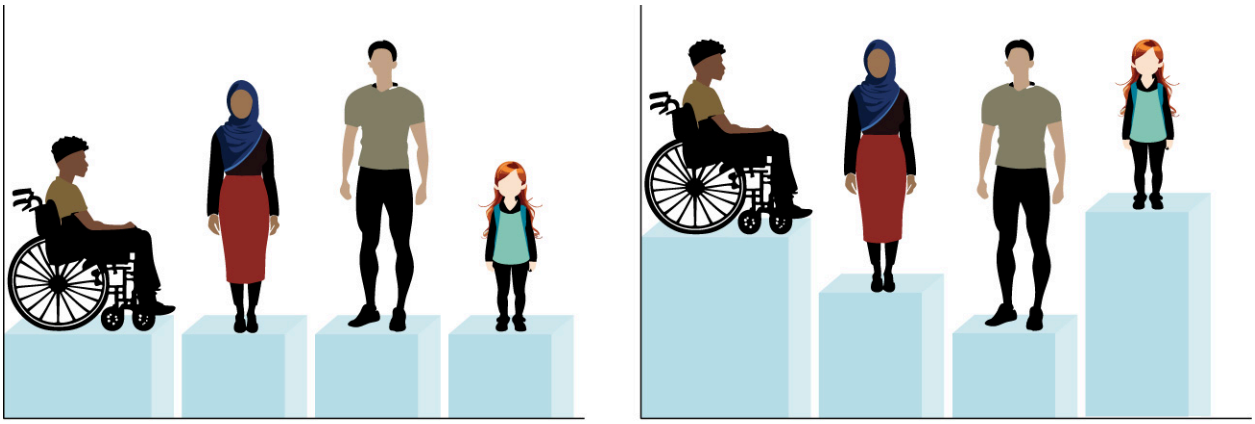

FIGURE 5.7 Health equality is providing the same resources and opportunities to all individuals, while health equity is ensuring that everyone has access to the resources they need to attain the same level of health, addressing systemic disparities and promoting fairness. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

A standard linked to fairness for all in society is **justice**, a principle and moral obligation to act on the basis of equality and equity. The ANA states this obligation guarantees not only basic rights (respect, human dignity, autonomy, security, and safety) but also fairness in all operations of societal structures. This includes care being delivered with fairness, rightness, correctness, unbiasedness, and inclusiveness while being based on well-founded reason and evidence.

The CDC (2022a) discusses diversity and inclusion as important factors in health equity considerations. Diversity refers to the existence of societies, communities, or subcultures that differ substantially from one another. Cultural competence means respecting and appreciating these similarities and differences. Inclusion is the practice of creating an environment in which individuals of all backgrounds feel respected, valued, and supported (CDC, 2022b). There are numerous factors that can prevent diversity, inclusion, and justice. These can in turn create health disparities that limit access to care and decrease outcomes for certain groups.

Race/Ethnic Heritage

Race is a socially constructed idea because there are no true scientifically or biologically distinct races. Humans are not biologically different from each other. However, race and ethnicity have an undeniable effect on healthcare access and outcomes. In **racism**, it is presumed that races are distinct from one another and that there is a

hierarchy to race, implying that races are unequal. As healthcare providers, nurses have an obligation to recognize the impact of racism on their patients and the communities they serve. In the United States, race and ethnic background have long played a role in health disparities among different populations.

Most underrepresented populations experience higher rates of chronic disease and premature death compared to the rates among White populations; however, some individuals from underrepresented groups, such as Asian and Hispanic immigrants, experience lower rates (National Academies of Sciences, Engineering, and Medicine, 2017a). American Indian, Alaska Native, and Black populations experience the highest infant mortality rates, while Asian and Pacific Islander populations experience the lowest (Figure 5.8). Black people are more likely than White people to die prematurely from heart disease, and Black men are twice as likely as White men to die prematurely from stroke.

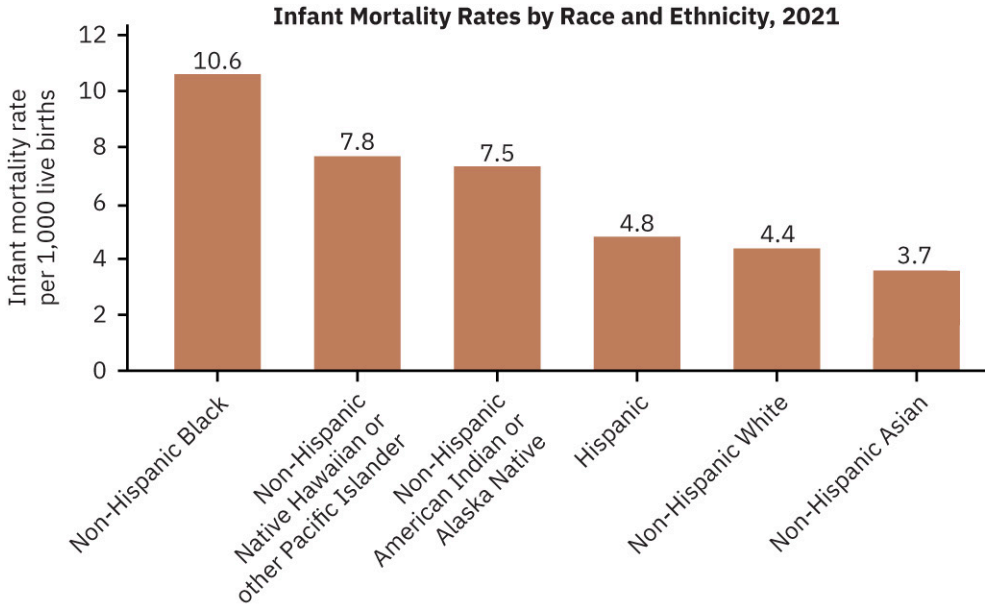

FIGURE 5.8 Infant mortality rates by race and ethnicity for the United States illustrate discrepancies between groups. (data source: Center for Disease Control and Prevention; attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Implicit bias related to race and ethnicity has been repeatedly shown in research to negatively affect patient care and outcomes. Nurses should also be sensitive to the fact that individuals from certain ethnicities may be distrusting of healthcare professionals due to cultural history and other factors.

Religion

Throughout human history, spirituality and health have often gone hand-in-hand. In many healing traditions, healers also serve as religious leaders (Figure 5.9). Many people consult and rely on their religious and spiritual beliefs when making medical decisions. For instance, Jehovah's Witnesses do not accept whole blood, plasma, and platelets because they believe that this might interfere with eternal salvation; they believe it is against God's will to accept blood products and will therefore not allow blood transfusions. A person's religious beliefs can affect their diet, what medications they will take, and approaches to death and dying. Healthcare providers must be prepared to take patients' religious and spiritual preferences into account as an important part of the treatment plan (Swihart et al., 2022). A thorough cultural assessment should include information on a patient's religious or spiritual beliefs that might affect their care.

FIGURE 5.9 Religion and health are closely intertwined for many people. (credit: "Guatemalan Clergymen Lead Sunday Mass Aboard USNS Comfort" by Navy Medicine/Flickr, Public Domain)

Age

Older adults struggle with some limitations in their care related to their age. Studies have shown that healthcare providers are more likely to assume that older patients' conditions, such as cognitive decline, are due to their age and to deny them certain treatments as compared to younger patients (Hughes et al., 2020). Older patients also tend to be undertreated for pain and depression. Older adults are more likely to live in poverty and have limited access to transportation, which can make it difficult to get to medical appointments.

Gender Identity and Sexual Orientation

A person's inner sensibility that they are a man, a woman, or perhaps neither is **gender identity**. The term **cisgender** is used to describe a person whose identity matches their sex assigned at birth. To the extent that a person's gender identity does not conform with the sex assigned to them at birth, they may identify as transgender or as gender nonbinary. The term **transgender** refers to someone whose gender identity or expression differs from traditional cultural gender roles for one's sex assigned at birth. Transgender people, like cisgender people, may be sexually oriented toward men, women, both sexes, or neither sex. Gender expression refers to a person's outward demonstration of gender in relation to societal norms, such as in style of dress, hairstyle, or other mannerisms. Sharing pronouns as part of a basic introduction to a patient can assist a transgender patient to feel secure sharing their pronouns in a healthcare setting. Asking a patient for their pronoun (he, she, they, ze) is considered part of a nursing assessment.

There is a strong body of research showing a history of gender bias in health care (Hughes et al., 2020). Providers are more likely to believe that the health complaints of women result from emotional instead of physical causes compared to men. There is also a demonstrated history of underdiagnosis and undertreatment of cardiovascular disease in women when compared to men.

A person's physical and emotional interest or desire for others is their **sexual orientation**. Sexual orientation is on a continuum and is manifested in one's self-identity and behaviors. The acronym LGBTQIA+ stands for lesbian, gay, bisexual, transgender, queer or questioning, intersex, or asexual in reference to sexual orientation. (The "+" is sometimes added after LGBTQIA+ to capture additional orientations.) Historically, individuals within the LGBTQIA+ community have experienced discrimination and prejudice from healthcare providers and avoided or delayed health care due to these negative experiences. Despite increased recognition of this group of people in recent years, members of the LGBTQIA+ community continue to experience significant health disparities.

Disability

Disabilities can be present from birth or acquired later in life. They can be physical, cognitive, or mental health related. Adults with disabilities are more likely than adults with no disabilities to report poor health, including higher

rates of obesity, diabetes, smoking, lack of physical activity, and cardiovascular disease. Adults with disabilities are also more likely to live in poverty, and even those with health insurance are less likely than adults without disabilities to seek care. Adults with disabilities also cite common stereotypes, bias, and beliefs among providers as barriers to care (VanPuymbrouck et al., 2020). Examples include lack of appropriate equipment to transfer patients with disabilities, or a healthcare provider's assumption that the patient is unhealthy or fragile simply because they have disabilities.

Education Level

Differences in educational levels can affect how people access healthcare services and understand health information to make informed decisions. The higher a person's level of education, the higher is their life expectancy and the more likely they are to access preventative and screening services (Viinikainen et al., 2022). People with lower education levels are more likely to have higher weight and to engage in risky activities such as smoking and heavy drinking (Viinikainen et al., 2022). In the United States, the health disparities between the most educated and least educated people have been increasing over the last forty years, leading to an increasing discrepancy in morbidity and mortality rates among these groups (Viinikainen et al., 2022).

Physical Characteristics

Certain physical characteristics have the potential to create barriers to care. Patients who are deaf or blind may need accommodations to ensure that communication is clear and accurate. American Sign Language interpreters can be sought for patients who are deaf. Educational materials and consent forms printed in Braille can assist blind populations.

Socioeconomic Status

In the United States, socioeconomic status is a major determinant of health status. Individuals from low socioeconomic groups, including those experiencing homelessness or living in poverty, are prone to higher rates of diseases like heart disease, diabetes, stroke, and obesity (Baggett et al., 2013; Fazel et al., 2014; National Academies of Sciences, Engineering, and Medicine, 2017b). This is attributed to their limited opportunities for early prevention and a lack of resources to adhere to standard treatment plans (Baggett et al., 2013; Fazel et al., 2014; National Academies of Sciences, Engineering, and Medicine, 2017b). For instance, someone experiencing homelessness is unable to perform clean dressing changes daily without adequate access to water. They also have higher rates of infant mortality, substance misuse, and shorter life expectancies. Additionally, they may report avoiding care because they feel discrimination from healthcare workers (Hughes et al., 2020).

In 2021, the majority of Americans relied on privately purchased insurance for their health care. Most of this insurance is made available through employers. About 35 percent of the population holds a public form of insurance in the form of Medicaid or Medicare. Medicare is for those who have been determined to need special care such as older people or those who experience certain disabilities. Medicaid is for those who need aid in receiving care, such as people who meet certain low-income guidelines (Keisler-Starkey & Bunch, 2022).

Veteran Status

Military veterans often have complex needs due to physical and psychological trauma sustained during military service and socioeconomic issues that arise after discharge (Figure 5.10). Many veterans struggle with a lack of access to healthcare benefits, sometimes based on residing in rural locations that do not have veteran-specific healthcare facilities. The Veterans Administration offers free health care to veterans who meet certain low-income guidelines, allowing these patients to be seen at any facility.

FIGURE 5.10 Veterans are an especially vulnerable population who often have complex needs. (credit: "210512-N-QB805-0110" by Navy Medicine/Flickr, Public Domain)

Factors Preventing Sensitivity to Diversity

Sensitivity to diversity can be hindered by several factors that are related to a person's experiences, attitudes, and knowledge. One significant factor is a lack of exposure to diverse individuals and cultures. Limited exposure can lead to a lack of understanding and appreciation for diversity. Stereotyping and prejudice can also contribute to insensitivity, as preconceived notions or stereotypes about certain groups can lead to discrimination and bias. Personal biases can influence perceptions and attitudes toward different groups, leading to insensitivity. Additionally, a lack of education or awareness about different cultures and backgrounds can lead to misunderstandings. Overcoming these barriers requires ongoing education, open-mindedness, and a willingness to learn about and appreciate different cultures and backgrounds. It also requires actively challenging one's biases and seeking out opportunities for exposure to diversity.

Stereotyping

The assumption that a person has the attributes, traits, beliefs, and values of a cultural group because they are a member of that group is termed **stereotyping**. Engaging in stereotyping prevents the ability to identify people's needs on an individual level. One common stereotype is the assumption that all older patients are forgetful or have memory problems. This stereotype can lead to medical professionals overlooking or dismissing legitimate concerns or symptoms of older patients, attributing them solely to age-related memory decline, which can in turn lead to misdiagnosis or delayed treatment. Stereotypes can be harmful to patients and must be avoided. Culturally competent care extends beyond general knowledge of a cultural group to knowledge of the individual themself.

Cultural Imposition

The imposition of one's own values, beliefs, and practices upon another person or group is **cultural imposition**. Cultural imposition runs counter to cultural humility and can manifest in various ways. Examples include disregarding a patient's cultural practices, beliefs, and values when making medical decisions, or imposing Western medical practices on non-Western cultures without consideration for their unique cultural beliefs and practices. For instance, healthcare providers may fail to consider a patient's traditional healing practices or the role of family members in healthcare decisions, which can lead to a breakdown in communication and a lack of trust between patients and healthcare providers. Cultural awareness can help the nurse recognize their own biases and avoid

cultural imposition.

Cultural Blindness

The belief that all cultural groups are the same and share identical experiences is **cultural blindness** (Bhattacharya et al., 2019). Different cultural groups can have vastly different experiences within the healthcare system. Cultural blindness might lead a nurse to conclude that all treatment services are adequate for all patients, contributing to the continuation of policies that prevent diversity and inclusion. For instance, a hospital might stock consent forms available in English and Spanish exclusively. However, despite a significant local Vietnamese population, the nurse consistently faces difficulty in locating consent forms in Vietnamese for these patients. This is a result of system-wide cultural blindness. Once the nurse identifies the issue, they can escalate it and have the issue addressed by having adequate Vietnamese-language consent forms available for the patient population.

To address cultural blindness in health care, providers should receive regular cultural competency training and actively work to understand and respect the diverse backgrounds of their patients. This includes learning about cultural beliefs and practices related to health and illness, as well as developing effective communication strategies that bridge language and cultural barriers.

Culture Conflict

A **culture conflict** occurs when there is tension or opposition between different cultures. Often, the dominant culture weakens the cultural practices of the minority group as a result (APA, n.d.b). Culture conflict can arise in many ways, such as when a patient's cultural beliefs around illness and healing differ from those of the healthcare provider, or when a patient's cultural practices conflict with medical protocols. For example, a patient who refuses to receive a blood transfusion due to religious beliefs may have conflict with the nurse who sees this treatment as medically necessary.

Culture conflict can also arise when healthcare providers make assumptions or judgments about patients based on their cultural background, leading to biases and discrimination. This can result in disparities in healthcare access and outcomes for patients from diverse backgrounds. Nurses should approach such conflicts with cultural humility to ensure they are resolved without damage to the nurse-patient relationship.

Barriers to Communication

It is necessary to overcome communication barriers to maximize the patients' opportunities for the highest quality care. According to the Agency for Healthcare Research and Quality (2020), approximately three out of 100 people in the United States have a hearing disability, and two out of 100 have a visual disability to the extent that they are blind or have trouble seeing even with corrective vision wear. Various strategies can help improve the communication process for these patients.

For patients with hearing barriers, offer print materials, text telephones (TTYs), or videos with captioning. Sign language interpreters use American Sign Language or Signed English; there are also oral and cued-speech interpreters who use articulation and gestures. When having conversations, make sure the television or other sources of background noise are silenced and the surrounding environment is free of distracting noise.

For patients with sight barriers, make sure that the lighting is at their comfort level. Whenever possible, provide assistance in the form of audio recordings, large-print materials, and screen magnifiers. Text-to-speech or Braille output screen reading software is also available.

Linguistic Competence

According to a recent study, nine percent of the U.S. population has limited English proficiency (Agency for Healthcare Research and Quality [AHRQ], 2020). Linguistically competent care aims to help reduce these discrepancies. The AHRQ defines linguistic competence as "providing readily available, culturally appropriate oral and written language services to limited English proficiency members through such means as bilingual/bicultural staff, trained medical interpreters, and qualified translators" (AHRQ, 2019).

Educational materials, instructions, and consent forms should be offered in the patient's preferred language and written using simple language. When caring for a patient whose primary language is not English and they have a limited ability to speak, read, write, or understand the English language, seek the services of a trained medical interpreter. Healthcare facilities are mandated by The Joint Commission to provide qualified medical interpreters.

Use of a trained medical interpreter is linked to fewer communication errors, shorter hospital stays, reduced thirty-day readmission rates, and improved patient satisfaction.

Refrain from asking a family member to act as an interpreter. The patient may withhold sensitive information from them, or family members may possibly edit or change the information provided. Unfamiliarity with medical terminology can also cause misunderstanding and errors.

Medical interpreters may be on-site or available by videoconferencing or telephone. The nurse should also consider coordinating patient and family member conversations with other healthcare team members to streamline communication, while being aware of cultural implications such as who can discuss what healthcare topics and who makes the decisions. When possible, obtain a medical interpreter of the same gender as the patient to prevent potential embarrassment if a sensitive matter is being discussed.

Some additional guidelines for working with a medical interpreter are as follows:

- Allow extra time for the interview or conversation with the patient.
- Whenever possible, meet with the interpreter beforehand to provide background.
- Document the name of the medical interpreter in the progress note.
- Always face and address the patient directly, using a normal tone of voice. Do not direct questions or conversation to the interpreter.
- Speak in the first person (using “I”).
- Avoid using idioms, such as, “Are you feeling under the weather today?” Avoid abbreviations, slang, jokes, and jargon.
- Speak in short paragraphs or sentences. Ask only one question at a time. Allow sufficient time for the interpreter to finish interpreting before beginning another statement or topic.
- Ask the patient to repeat any instructions and explanations given to verify that they understood.

Summary

5.1 Understanding Cultural Differences

Culture is a set of beliefs, attitudes, and practices shared by a group of people or community that is accepted, followed, and passed down to other members of the group. An individual's cultural background influences their beliefs, feelings, and attitudes toward health care. Their culture informs how they view health and illness, how they view healthcare providers, and how receptive they are to treatment plans. Culture also determines who receives care and the quality of their care. Certain cultures experience higher rates of disease due to genetics or health disparities caused by socioeconomic factors. Various cultures have their own traditional healing practices and beliefs, and many people still use these practices either alongside or in place of Western medicine. Nurses often care for patients from cultures different than their own, with different beliefs and practices. Respecting individual differences and staying mindful of both explicit (conscious) and implicit (unconscious) biases are crucial to counteract such biases and ensure the delivery of optimal care.

5.2 Ethical Practice in Culture and Diversity

Accommodating diverse cultural practices begins with the practice of cultural humility. By seeking cultural assistance from appropriate sources and practicing cultural negotiation, the nurse can demonstrate respect for diverse cultures. Engaging in cultural diversity practices can range from one-on-one conversations with patients, to researching written history, to actively participating in different cultural activities and experiences. Being responsive to cultural diversity involves understanding cultural differences and being willing to overcome personal biases to accommodate the cultural preferences of a patient in order to provide the most culturally competent care.

5.3 Cultural Practice in Nursing

When providing care for patients from diverse cultural practices, it is necessary to perform a thorough cultural assessment to gain information on patient-specific details. The Transcultural Nursing Society developed Standards of Practice for Culturally Competent Nursing Care, which serve as universally applicable guidelines for nurses in all aspects of culturally competent nursing care. Cultural competency is important because it has the power to improve the quality and safety of care and lead to better health outcomes for culturally diverse patients. Various factors can impact diversity and inclusion in nursing, including the six cultural phenomena: communication, space, social organization, time, environmental control, and biological variations. The best way to counteract this is to identify biases and change practices going forward.

5.4 Diversity, Equity, and Inclusion

Important considerations related to providing equal, diverse, and inclusive nursing care include health equity and health disparities. The nurse should be aware of possible disparities in the patient population and strive to foster a culture of mutual respect, understanding, and support, which can lead to improved patient outcomes. Factors that can prevent diversity and inclusion include stereotyping, cultural imposition, cultural blindness, and culture conflict. Barriers to communication can affect diversity and inclusion by causing barriers to inclusion related to language, literacy, and accessibility for all patients, not just deaf and blind patients.

Key Terms

alternative therapies nonmainstream approaches that are used in place of conventional Western medical care
Ayurveda a traditional Hindu form of medicine from India that is based on the idea that disease is caused by an imbalance in the body
cisgender a person whose identity matches their sex assigned at birth
collectivism when a culture emphasizes the importance of the community over the individual
complementary therapies nonmainstream approaches to health that are used alongside conventional Western medical care
cultural blindness the belief that all cultural groups are the same and share identical experiences
cultural competence applying evidence-based nursing in agreement with the cultural values, beliefs, worldview, and practices of patients to produce improved patient outcomes
cultural humility a humble and respectful attitude toward individuals of other cultures that pushes one to challenge their own cultural biases, realize they cannot know everything about other cultures, and approach

learning about other cultures as a lifelong goal and process

cultural imposition the imposition of one's own values, beliefs, and practices upon another person or group

cultural knowledge seeking information about cultural health beliefs and values to understand patients' worldviews

cultural negotiation a process by which the patient and nurse seek a mutually acceptable way to deal with competing interests of nursing care, prescribed medical care, and the patient's cultural needs

cultural self-awareness a person's understanding of their own culture and its impact on themselves

culturally responsive care care that occurs when an individual's cultural beliefs are integrated into their health care

culture a set of beliefs, attitudes, and practices shared by a group of people or community which is accepted, followed, and passed down to other members of the group

Culture Care Theory (CCT) (also known as Theory of Culture Care: Diversity and Universality) framework for transcultural nursing and the development and practice of culturally competent nursing care

culture conflict tension or opposition between different cultures

curanderismo a holistic practice rooted in beliefs that health is achieved through the right balance of mind, body, and spirit

ethnocentrism the belief that one's culture (or race, ethnicity, country) is better than and preferable to another's

explicit bias a consciously held set of beliefs about a particular person, situation, or group of people based on characteristics

gender identity a person's inner sensibility that they are a man, a woman, or perhaps neither

health disparity differences in health outcomes that result from social determinants of health

health equality the principle of ensuring all individuals, regardless of their background or socioeconomic status, have equal access to healthcare resources and opportunities

health equity when everyone has a fair opportunity to obtain optimal health

holistic nursing care nursing care that emphasizes the healing of the whole person, including mind, body, and soul

implicit bias an automatic reaction toward a person, situation, or group of people involving subconscious feelings, perceptions, attitudes, and stereotypes

inclusion the practice of creating an environment in which individuals of all backgrounds feel respected, valued, and supported

individualism when a culture focuses on the importance of the individual over community

interpersonal component of cultural humility that involves respect for the patient's culture and openness to their beliefs and experiences

intrapersonal component of cultural humility that consists of a personal awareness of one's own limited knowledge of the patient's culture

justice a principle and moral obligation to act on the basis of equality and equity

racism the belief that races are distinct from one another and that there is a hierarchy to race, implying that races are unequal

sexual orientation a person's physical and emotional interest or desire for others

social determinant of health (SDOH) economic, social, and environmental factors that influence an individual's health and well-being

stereotyping the assumption that a person has the attributes, traits, beliefs, and values of a cultural group because they are a member of that group

Traditional Chinese Medicine (TCM) an ancient practice based on the ideas of Qi and yin and yang

traditional healing various medicines and healing practices around the world that differ from the modern, Western healthcare system

transcultural nursing nursing that incorporates cultural beliefs and practices of individuals to help them maintain and regain health or to face death in a meaningful way

transgender a person whose gender identity or expression differs from traditional cultural gender roles for one's sex assigned at birth

Assessments

Review Questions

1. What is the term used to refer to the integration of an individual's cultural beliefs into their health care?

a. cultural integrity
b. culturally competent care
c. holistic care
d. integrative care

2. A patient is admitted to the medical-surgical floor for uncontrolled hypertension. He is a seventy-five-year-old Hispanic man who speaks fluent English. He tells the nurse that he has been seeing a curandero, or traditional healer, for his health issues for the last several years. What is the best initial response from the nurse?
a. Ask the patient for a list of all herbs, plants, and special diets that he is currently taking.
b. Educate the patient on why adherence to a Western medical treatment plan is better for his health.
c. Inform the patient that the treatment he has been receiving from the curandero is not evidence based.
d. Tell the patient he is welcome to continue whatever traditional treatments he likes while he is in the hospital.

3. You are a nurse and have just finished taking a course on identifying implicit bias. You decide to journal after one of your shifts to reflect on any possible instances of implicit bias in your workday. What might an interaction reflecting implicit bias look like?
a. You are frustrated when you learn during report that one of your patients is an 82-year-old male with dementia who is forgetful, difficult to redirect, and often agitated.
b. You learn that one of your patients went to another high school in your hometown. You rush through your medication pass so you can spend some extra time talking to this patient.
c. One of your patients is a 59-year-old female from Syria. During report, the patient's previous nurse explains to you that the patient's husband is at the bedside and that when the patient is questioned, he usually answers the questions for her. The nurse states "I think it's really sexist, but they are from the Middle East."
d. You enter the room of your patient who is a 23-year-old Black female with a history of alcohol misuse. She is on alcohol withdrawal protocol and has orders for frequent vital signs. She shares with you her drinking history and how difficult it is for her to stop. You empathize with her and tell her you are supportive of her efforts to get sober.

4. What is the term used to describe nonmedical factors that influence health outcomes, including conditions in which people are born, grow, work, live, and age, and the wider sets of forces and systems shaping the conditions of daily life?
a. environmental influences
b. life circumstances
c. situational occurrences
d. social determinants of health

5. A process where the patient and nurse seek a mutually acceptable way to deal with competing interests of nursing care, prescribed medical care, and the patient's cultural needs is known as cultural negotiation. What would be an example that demonstrates cultural negotiation?
a. a nurse insisting the patient shave his facial hair
b. a nurse demanding daily medication be taken at 0900, when the patient wakes daily at 0500
c. a nurse planning to keep the patient's hijab in place for a surgical procedure
d. a nurse requesting a special religious healer visit the patient after admission

6. While learning about Chinese culture and attending local presentations on culturally competent care, you discover a local event happening in your area. You decide to ask a group of coworkers to join you in attending a local Chinese New Year parade. This is an example of engaging in what type of cultural diversity practice?
a. active learning
b. interpersonal awareness
c. intrapersonal awareness

d. willingness to change

7. What is an example that illustrates being culturally competent?
   a. attending an Indian dance night at a local community center
   b. educating the patient on your own cultural practices
   c. implementing a system to improve cardiovascular health screening procedures for Black women at your hospital
   d. insisting a patient answer your questions instead of her husband answering

8. What is an example of cultural humility?
   a. a nurse allowing a non-English-speaking patient's son to translate for them
   b. a nurse listening to a patient who is pregnant explain why they want a traditional midwife from their own culture present in the room while they are delivering their baby
   c. a nurse administering a new medication to a patient with limited English, even though the translator is late, so that it can be given on schedule
   d. a nurse giving the patient discharge paperwork printed in their preferred language because they do not have time to verbally discuss discharge instructions with the patient

9. What is the purpose of the Theory of Culture Care: Diversity and Universality?
   a. to provide a framework for transcultural nursing and the development and practice of culturally competent nursing care
   b. to explain the many cultural differences that exist among communities
   c. to shape the beliefs of nurses regarding certain health- and wellness-related customs among historically marginalized communities
   d. to provide patients with a way to address health disparities and systemic inequality in the healthcare system

10. Taking a test to examine your own implicit biases is an example of which of the twelve standards of practice for culturally competent nursing care?
   a. critical reflection
   b. culturally competent practice
   c. knowledge of cultures
   d. social justice

11. According to Giger and Davidhizar's Six Cultural Phenomena, all communication exists in the context of which factor?
   a. biology
   b. environment
   c. space
   d. time

12. What is one important purpose of cultural competency?
   a. to improve the quality of care leading to better health outcomes for culturally diverse patients
   b. to ensure that the predominant cultural voices in a community are the ones who shape healthcare practices
   c. to prevent unscientific beliefs from influencing important medical decisions
   d. to provide education to cultural communities on how they can best adapt their practices to suit the modern healthcare system

13. What term describes the state in which everyone has a fair and just opportunity to obtain their highest level of health?
   a. health equality
   b. health equity

c. fairness
d. justice

14. You receive report from another nurse who tells you that your patient is an 82-year-old Chinese female. You know that you will have a good day with this patient as older Asian women are usually very polite, easy to get along with, and compliant with your requests. What prevents you from recognizing diversity and inclusion?
a. cultural application
b. cultural blindness
c. ethnocentrism
d. stereotyping

15. You have a patient who is Spanish-speaking only, and you are required to obtain their signature on a consent form. The patient requests that their family member interpret for them. What is the most appropriate response?
a. Ask the family member to leave the room and use an official translator.
b. Find an official translator to assist with the conversation along with the patient and family member.
c. Proceed with allowing the family member to interpret.
d. Tell the patient that you are only allowed to use official translators or interpreters.

Check Your Understanding Questions

1. Describe ways in which a nurse can provide culturally sensitive nursing interventions for a patient in pain.

2. Describe how a nurse can overcome implicit bias.

3. List some specific ways in which to engage in cultural diversity practices.

4. What are some ways to demonstrate responsiveness to diversity and inclusion?

5. Describe the steps to beginning a culturally sensitive nursing assessment.

6. List five different types of alternative and complementary therapies.

7. Why do you think the Transcultural Nursing Society included Multicultural Workforce as one of their Twelve Standards of Practice for culturally competent care?

8. Describe the guidelines for working with a medical interpreter.

Reflection Questions

1. Why is it important for nurses to be aware of the health practices associated with various cultures?

2. Why is cultural humility such an important part of cultural competence?

3. The concept of cultural blindness is the belief that all cultural groups are the same and share identical experiences. How would experiencing cultural blindness be a barrier to diversity and inclusion?

Critical-Thinking Questions about Case Studies

1. Refer to Unfolding Case Study #1: Part 7.
How would you react if the patient requested to perform a traditional healing method including prayer, candles, and herbs during their stay in the hospital?

2. Refer to Unfolding Case Study #1: Part 9.
What are some ways the nurse could display cultural competence when caring for the patient?

What Should the Nurse Do?

1. Francine, a new graduate nurse, was offered a full-time position on the dialysis floor of an acute care hospital. The new hire process includes a six-week training program that allows the new hire to observe and work closely with a seasoned employee. On Francine's first shift, she realizes that she has been assigned to

shadow Muhammad. Muhammad has been an employee for over ten years and was awarded Nurse of the Year two years ago. Francine notices that with each patient interaction, he educates the patient on both conventional Western medical treatments and traditional healing remedies. Francine is very confused; she thought that Western medicine was superior to that of traditional healing practices. She decides to confront Muhammad. If you were Muhammad, how would you explain to Francine that her thought process is impacting diversity and inclusion?

2. The nurse is assigned to care for a patient whose background differs from their own and wants to make sure to identify factors that can prevent diversity and inclusion when assessing the needs for this patient and family. What factors should the nurse consider?
3. A new graduate nurse takes a job with a travel company and for the first time leaves her southern state. She is stationed in an area that primarily serves a Jewish-based population. She has never cared for this population but wants to learn as much as possible while on this assignment. After analyzing content from this chapter, apply some factors that can prevent the nurse from achieving diversity and inclusion in her new setting. How would the nurse achieve incorporating these factors?

Competency-Based Assessments

1. Use various sources to research diverse cultural communities in your region. Note important cultural factors such as language, race/ethnicity, and religion. Discuss how these cultural factors might impact the abilities of these diverse communities to access health care.
2. Identify a diverse cultural event in your community in which you can actively participate, such as a meal, dance, or festival. Attend the event and write a journal entry about your experience. What did you learn about diversity at this event? Did it help you to identify any implicit biases? What lessons will you take with you as you begin your nursing practice?
3. Have you ever experienced or witnessed an interaction where there was a lack of cultural competency? What factors caused the lack of cultural competency? Discuss how you can use your experiences to ensure better diversity and inclusion in nursing.
4. Develop a fifteen-minute presentation on an alternative or complementary therapy.

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CHAPTER 6

Infection Prevention Techniques and Safety in the Clinical Setting

FIGURE 6.1 Handwashing is the single most important technique to stop the spread of infection. (credit: "20120106-OC-AMW-0074" by Flickr/USDA, Public Domain)

CHAPTER OUTLINE

6.1 Infection Cycle
6.2 Asepsis and PPE
6.3 Sterile Technique
6.4 Infection Control and Patient Safety

INTRODUCTION Nurses are responsible for consistently providing patient care that adheres to current evidence-based practices and meets professional standards and guidelines. There are effective scientific and practical control methods to prevent the development of infection and the transmission of diseases in a healthcare setting. Nurses provide healing care to patients of all ages and stages of life. While they are able to foster the emotional aspects of healing, clinical safety must be at the forefront of decisions to make sure both patients and healthcare providers remain safe. While it is widely understood that practices such as handwashing and covering a sneeze are important in everyday life, nurses hold a deeper responsibility to prevent and control infection against the most dangerous infectious agents.

6.1 Infection Cycle

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the infection cycle
- Identify the different stages of infection
- Explain the two responses the body has as defense mechanisms against infection

Nurses are on the front lines of **infection control**, which is the discipline of stopping or preventing the spread of infectious agents, and play an essential role in the prevention of infectious diseases. It is crucial for nurses to understand how infectious diseases spread to ensure vigilance and perform proactive initiatives to prevent and control infections. Microorganisms play a major role in the transmission of diseases. By understanding the conditions that foster the spread of infection, nurses can implement evidence-based interventions to break the cycle and stop the chain of infection. The process of infection control includes handwashing, environmental sanitizing, proper waste management, and adherence to isolation precautions. The main goal of infection prevention for nurses is to prevent the transmission of diseases. Nurses must understand how infections occur and how infection-prevention protocols work to prevent such infections. In doing so, they will ultimately protect themselves and their patients against exposure to infectious agents. Such knowledge includes an understanding of the infection cycle, how and why infections manifest, use of personal protective equipment (PPE) and sterile technique, and the most effective ways to control infections. While proper handwashing is a critical component of infection prevention, there are a number of other ways that nurses can stem the spread of infection and protect themselves and their patients.

An infection that has developed within a healthcare setting is called a **healthcare-associated infection (HAI)**. HAIs can develop from contact within the healthcare setting or as a result of healthcare interventions that take place outside of a healthcare setting. HAIs can spread rapidly and are a serious threat to nurses, patients, families, and the overall hospital system. Patients who develop any infection are at risk for prolonged hospital stays, long-term complications, and/or death, but HAIs are specifically dangerous as they are typically resistant to bacterial treatment and spread rapidly to often immunocompromised hospitalized patients. In the 2021 National and State Healthcare-Associated Infections Progress Report, the Centers for Disease Control and Prevention (CDC) found that each day approximately one in thirty-one U.S. hospital patients will contract an infection associated with their health care (CDC, 2022).

The Infection Cycle

In order for an infection to spread from one individual to another and cause disease, six specific phases must occur. This process is known as the **chain of infection**, and it only results in infection if all six links of the chain are present and intact (Figure 6.2). The six links are a causative agent, a source, a means of exit from the body, a method of spread, a way into the body, and a susceptible host. This chain can occur from a direct transmission between a current and future host or through a more complex pathway where transmission results from multiple intermediate hosts. If, at any time, one of the links breaks, the spread of the infection will halt. In order to break the chain, it is important for nurses to understand how the sequence and function of each link in the chain operates.

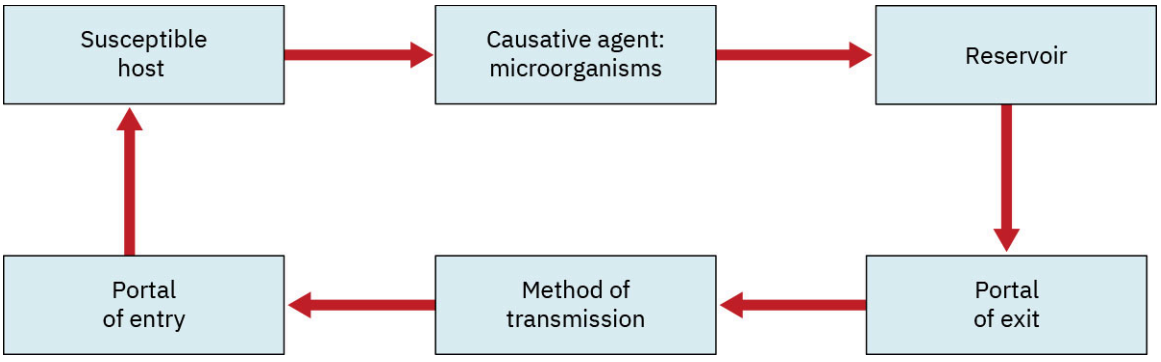

FIGURE 6.2 Each of the stages within the chain of infection represents a requisite condition necessary for the spread of infectious diseases. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Causative Agent: Microorganisms

Single-celled, microscopic organisms called microorganisms are too small to be seen by the naked eye. Their presence as the "causative agent" is the first step in the chain of infection. The term microorganism encompasses different life-forms with individual and unique sizes and characteristics. The most common types of microorganisms are bacteria, viruses, and fungi. They are found in all elements of life, including water, soil, air, and the human body. Not all microorganisms that live on the human body cause negative outcomes, and certain bacteria are beneficial to human health and well-being. Still, certain microorganisms can cause severe infection, spoil food, and destroy other materials.

Normal Flora

The community of microorganisms that can live on another living organism or inanimate object without causing any diseases or complications is called **normal flora**. From the moment of birth, humans are colonized with normal flora by passage through the birth canal. This normal flora helps to prevent individuals from becoming colonized with more dangerous bacteria, which could result in infection. There are two groups of normal flora.

- Resident flora is predominantly present in a particular area of the body and cannot typically be removed with standard hand hygiene. When disturbed, it re-establishes itself harmlessly in deep layers of skin.
- Transient flora includes microorganisms that are acquired by contact with objects or another person. These microbes can be nonpathogenic or pathogenic. Handwashing is effective in removing these microbes.

Infectious Agent

A **pathogen** is defined as any type of microorganism that causes disease to its host. Pathogens are also referred to as infectious agents, because they cause infections within the body. Pathogens are comprised of viruses, bacteria, fungi, protozoa, worms, or prions. Temperature, moisture, pH levels, oxygen, and access to water are all factors that contribute to a pathogen's ability to grow.

Bacteria are single-celled organisms that can live in or on people's bodies. Certain bacteria are beneficial to humans and can help digest food or enhance the immune system. However, when bacteria cause an infection, antibiotics can be used to either kill the bacteria or prevent their multiplication. Viruses, by contrast, do not have cells of their own; they are built from short sequences of either DNA or RNA that are required for the virus to reproduce. Viruses invade healthy cells that they establish as a host and then begin to multiply from within those cells. Their mode of replication occurs as a burst of thousands of particles from a single virus over a short period of time. Outside of a healthy host cell, viruses are dormant and unable to reproduce due to a lack of materials. Antibiotics do not work to kill viruses, but antivirals may be available to lessen the severity of symptoms. Treatments such as antipyretics, throat lozenges, and saline spray can be provided to support symptom management and support the patient's immune system as they work to fight an active infection. Vaccinations are an excellent example of a tool available to help prepare the immune system to recognize and fight a viral infection by providing passive immunity.

Normal flora can become a pathogen if it presents itself in a region of the body where it is not typically found. For example, multiple bacteria found in the bowels are harmless within that environment, but they can cause an infection if present in the urinary tract. The body's extreme response to widespread infection, called **sepsis**, is the outcome of an inappropriate immune response to an infection that results in function failure in multiple organ systems within the body. Severe complications to organs may occur if untreated, which can ultimately lead to death.

Reservoir

All infectious disease agents require a host species to flourish. The **reservoir** is the habitat or source of the pathogen. The reservoir can be viewed as the pathogen's home, providing a place for the pathogen to survive, grow, and multiply. Most pathogens thrive within a warm, moist, and dark environment. This is why the human body is the most common reservoir for pathogens. Additionally, animals, insects, food, water, and environmental surfaces can all be reservoirs for pathogens.

Human reservoirs may or may not show signs and symptoms of infection or illness. A carrier is a person who does not display any signs of infection but can still transmit the pathogen to other people. Asymptomatic carriers have the pathogen, but do not display any symptoms. Many times, they do not know they have the pathogen and unintentionally contribute to the spread of infection throughout a given population. But pathogens do not only travel from human carriers to other humans. People can also become infected from pathogens that have animal reservoirs.

Most of these pathogens are transmitted between animals, but a human may become an accidental host. The term **zoonosis** refers to an infectious disease that can naturally transmit from animal to human. Common examples of zoonotic diseases include *Yersinia pestis* from rodents, *Bacillus anthracis* from sheep, ZIKA from mosquitos, and *Flaviviridae* from birds. Environmental matter, such as water and soil, can also act as a reservoir for certain infectious agents. The agents that cause tetanus (*Clostridium tetani*) and botulism (*Clostridium botulinum*) can survive for years within soil and remain infectious for humans. So, whether a pathogen comes from a human or animal reservoir or from environmental matter, it can still cause disease once it is transmitted.

Portal of Exit

For an infection to spread, a pathogen must leave its existing reservoir. The **portal of exit** is the path by which the pathogen leaves the reservoir; in the case of humans, the most frequent route is through bodily fluids or coughing/sneezing. The body's natural response is to remove a pathogen and attempt to expel it. The portal of exit usually corresponds to the localized site of the pathogen. Examples of this include the influenza virus, which exits the respiratory tract through coughing and sneezing, or *Clostridioides difficile* in the gastrointestinal tract, which exits through stool. Broken skin—such as wounds, abrasions, bites—can serve as a portal of exit for pathogens through blood and purulent drainage, which is commonly known as pus, and appears as thick white, yellow, or brown fluid. Blood-borne pathogens can transmit from mother to fetus by crossing the placenta.

Methods of Transmission

The method that a pathogen uses to spread from one host to another is called **transmission**. The most frequent mode of transmission of pathogens is through contact, either direct or indirect (Figure 6.3).

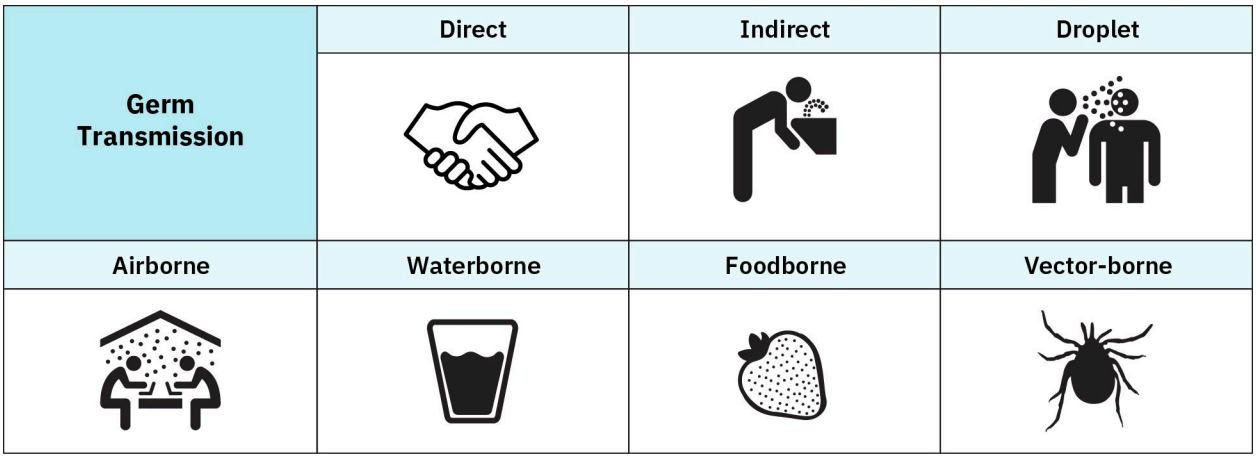

FIGURE 6.3 Germs can be transmitted via multiple routes, which include direct contact, indirect contact, droplets, the air, water, food, and vectors. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

- A process called **direct transmission** occurs when a pathogen transfers directly from an infected person. The pathogen can be passed from person to person through direct transmission. This mode of transmission can occur during any physical contact with a patient, including activities such as bathing, changing dressings, drawing blood, turning, and activities of daily living.
- A process called **indirect transmission** occurs when a pathogen is spread to a new host through an intermediary such as the air, food, water, animals, or objects. Certain pathogens can live only a few minutes outside of a host while others can live for years in the proper environment. Indirect transmission can occur in a hospital from, for example, ineffective hand hygiene, improper cleaning of medical equipment, and failure to change gloves between patients. Other forms of indirect transfer from within a hospital include equipment that is transferred from one patient's room to another, such as medication carts, vitals machines, and glucose monitors. These items require extra care when cleaning.
- A process called **droplet transmission** occurs when a pathogen travels through a spray of water droplets that are released when an infected person coughs, sneezes, or talks. These droplets are typically inhaled through the nose, mouth, or eyes. Due to their larger size (> 5 μm), droplets are propelled only a short distance through the air and do not remain suspended, so droplet spread is classified as direct transmission and does not require an intermediary. Examples of diseases that transmit through droplets include influenza, rubella, pertussis, and meningococcal infection.

- A process called **airborne transmission** occurs when pathogens are carried by dust or the nuclei of an evaporated droplet and remain suspended in the air. Because of their small size (5 µm or smaller), these nuclei can remain suspended in the air for long durations of time, float considerable distances, and potentially infect large groups of people. For instance, SARS-CoV-2 coronavirus transmission can occur in a room in which an infected person had previously been, because the virus remains suspended in the air. Because airborne transmission occurs through the inhalation of the pathogen by a susceptible host, healthcare facilities need to put into place special air-handling processes, such as negative pressure, to prevent infection.
- A process called **vector transmission** occurs when blood-feeding arthropods infect animals or humans. Examples of blood-feeding arthropods are fleas, ticks, and mosquitos. Commonly known vector-borne diseases include malaria, Lyme disease, and West Nile virus.

Portal of Entry

The site through which a pathogen enters the susceptible host is called the **portal of entry** (Table 6.1). Commonly, pathogens enter a new host using the same portal of exit utilized to leave the reservoir. For example, if the pathogen is transmitted from the respiratory tract through a sneeze or cough, then the portal of entry would also be the respiratory tract of the new host from inhalation of the droplets or touching a surface contaminated with the droplet and touching a mucous membrane. In healthcare settings, wounds, surgical sites, intravenous access sites, and indwelling catheters can all provide a portal of entry for pathogens.

Portal of Entry	Description
Mucosal	Through the eyes or nose
Respiratory	Through the respiratory tract
Genitourinary	Through the urinary tract
Cutaneous	Through wounds or abrasions
Gastrointestinal	Though the intestinal tract

TABLE 6.1 Portals of Entry for Infection

Susceptible Host

The final link in the chain of infection is a **susceptible host**, the organism or person at risk for infection. The degree to which a host is at risk is dependent on their immunity and ability to resist or limit susceptibility. A host may have specific immunity to a particular pathogen through protective antibodies. The antibodies may have developed as a response to a previous infection, toxin, or vaccine. Factors that increase susceptibility include age, chronic illnesses, a compromised immune system, or immune deficiency.

LIFE-STAGE CONTEXT

Susceptibility to Infection

Age is a nonmodifiable risk factor. As adults age, their functional immunity declines, which increases their susceptibility to infection. Older adults are more prone to developing an infection due to multiple factors: the immune system no longer functions as optimally or vigorously; they may experience cognitive impairments, which could make them less likely to comply with necessary hygiene practices; and they are more likely to be diagnosed with comorbidities, such as diabetes, heart failure, or rental insufficiency, all of which can affect the body's ability to fight infections.

As individuals age, their lifestyles typically change as well. Nutritional intake can decrease, reducing protein, vitamins, and electrolytes. This can lead to a decrease in body mass, which increases susceptibility to infections.

The National Institute on Aging recommends vaccination as the number one way to prevent infections in an aging

population. The Institute also seeks to reduce the number of infections by promoting healthy aging. This entails remaining active and continuing modified physical activity, enjoying proper nutrition, and maintaining regular and routine appointments with health providers (National Institute on Aging, 2022).

Stages of Infection

All infections progress through a predictable course of four stages (Figure 6.4). Each pathogen can produce distinct and diverse symptoms. An individual's immune response to the pathogen will determine the length and intensity of each stage and account for variability seen between one individual and another.

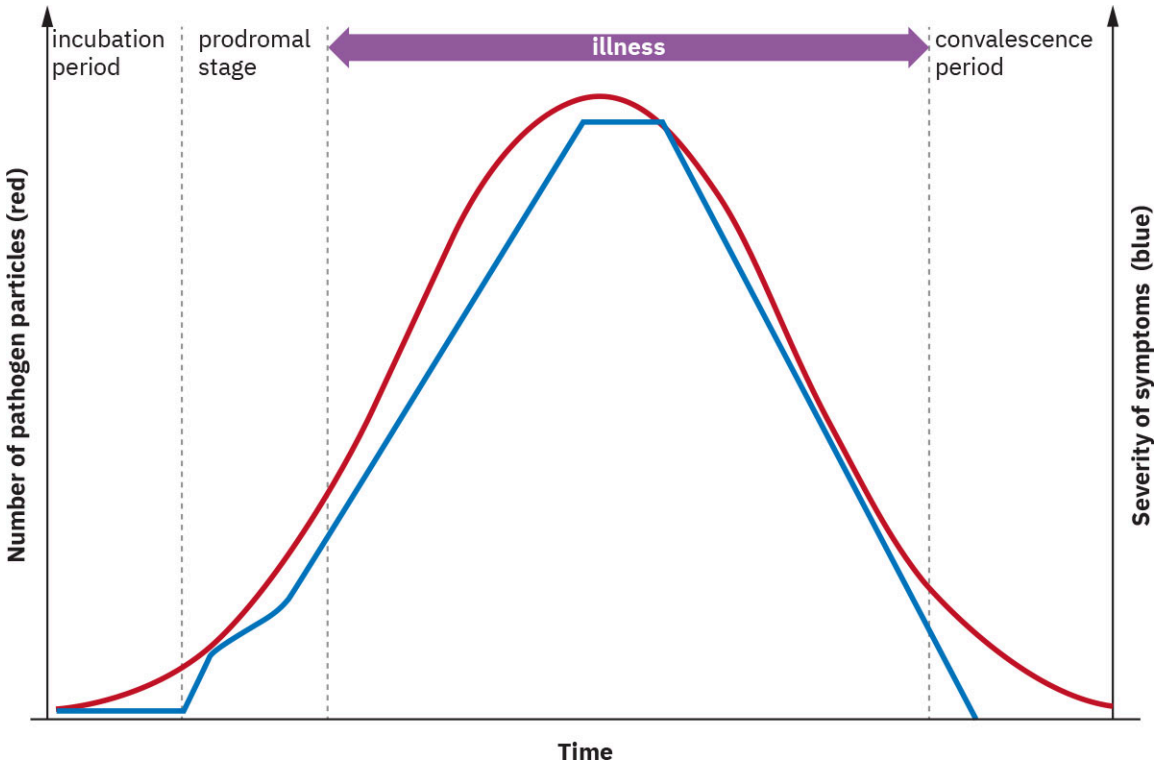

FIGURE 6.4 Infections are either localized or systemic, but all infections go through four stages. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Incubation Period

The stage of infection known as the **incubation period** begins once a pathogen successfully enters a new host. During the incubation period, a person does not show signs and symptoms of an infection because there are not enough pathogens to cause symptoms. The person therefore does not suspect they have been infected. One example is the common cold. The patient feels healthy for one to three days, but then starts to demonstrate symptoms of illness once the level of pathogen has increased in their system. Despite being asymptomatic those first few days, pathogens are continually multiplying and can still be spread to other hosts. Because of this, the longer the incubation period is, the more likely a person is to be unknowingly spreading infection to other people. The incubation period can vary in time from as little as one day, as with the influenza virus, to two to three months, as with the hepatitis B virus. It can even last years, as with the human immunodeficiency virus.

Prodromal Stage

The stage of infection called the **prodromal period** begins at the initial appearance of mild or vague symptoms. These symptoms arise as a result of activation of the immune system and typically present as fever, pain, soreness, or inflammation. Symptoms at this stage are often too general to indicate a specific disease. Referring to the patient exposed to the common cold, after one to three days of feeling healthy, they may then have symptoms such as a headache, scratchy throat, and watery eyes. Though present, these symptoms are nonspecific and could be associated with a variety of other illnesses. This stage can vary in its duration, but it is typically shorter than the incubation period.

Illness

The **illness period** stage of infection begins when a person experiences the specific signs and symptoms of a certain disease. This period represents the peak of the infection, and it is during this time that a person is highly contagious. In this stage, our patient who was exposed to the common cold will start to show specific symptoms such as mild hacking cough, sneezing, achy muscles and bones, and low grade fever. If the individual's immune system (with or without medical intervention) is able to combat the pathogens, a period of decline in the pathogens begins. The infection begins to weaken, and symptoms decrease.

Convalescent Period

The final stage of infection is the **convalescent period**. This is the stage where recovery and healing begin. Closing out our example of the patient who has the common cold, the patient's symptoms will fade, and the patient will report feeling back to baseline. During this time, a person is gradually able to return to their normal functions; some infections, however, can result in permanent damage from which the body is unable to repair and recover.

Body's Natural Defense Mechanism Against Infection

The human body's immune system provides a mechanism for staying healthy through protection against harmful pathogens. An immune response can be classified as either nonspecific, meaning it targets pathogens in a nonspecific, less effective manner, or specific, which allows for a high level of adaptation and effectiveness. Nonspecific immunity includes physical, chemical, and cellular defenses that are classified as either primary or secondary. Secondary defenses are broken down further into inflammatory and immune responses. Specific defense would be antibodies from the immune system targeting a specific antigen that they are designed to identify and destroy.

Primary Defenses

Primary defense barriers prevent pathogens from entering the body through structural barriers, destroy them once they have entered the body, or flush them out of the body (Table 6.2). These barriers are not triggered as a response to pathogens but instead serve as a continuous first line of defense against infection.

Defense	Description
Skin	The skin provides a highly effective physical barrier to infection. The top layer of skin, the epidermis, is made up of cells containing keratin, which makes the skin surface mechanically tough. If skin integrity is compromised due to injury, such as abrasions, cuts, incisions, or burns, the barrier is breached, which creates a portal of entry.
Mucous membranes	The mucous membranes that line the nose, mouth, lungs, and digestive and urinary tracts are coated with secretions that aid in fighting against potential pathogens. The nares, trachea, and bronchi are coated with mucous membranes that trap pathogens. Coughing and sneezing allow pathogens to be forcibly expelled from the body.
Stomach	The acidic environment of the stomach destroys pathogens that enter the digestive tract. Normal peristalsis—the muscles moving food through the digestive tract—as well as vomiting and diarrhea work to remove pathogens that enter the tract. Additionally, the natural flora of the body, specifically in the gastrointestinal system, serves as a defense mechanism.
Eyelashes and eyelids	These structures provide a physical and mechanical barrier from dust and airborne microorganisms through blinking; tears wash away organisms.
Cilia	Housed in the nares, cilia move a layer of mucus that covers the airways. This mucus traps pathogens, preventing them from reaching the lungs.

TABLE 6.2 Primary Defense Barriers to Infection

Inflammatory Response

Pathogens that are not stopped by primary mechanisms and are able to enter the body trigger a second set of

defenses. Nonspecific, innate immune responses work to recognize and eliminate pathogens.

One of the first responses that occurs when a pathogen breaches the nonspecific innate immune system is an **inflammatory response**. This response can entail an area of the body by swelling, turning red, feeling hot, having pain, or losing function. Although inflammation is often perceived as a negative consequence that results from injury, it actually establishes a physical barrier against infection. The process of inflammation aids in the recruitment of cellular defenses, which remove pathogens and damaged cells while initiating repair mechanisms.

The process of inflammation is triggered when damaged cells release histamines and other chemicals. The rise in histamines increases the permeability of the blood vessels, which results in additional blood flow to the area. This additional blood flow manifests as localized warmth and redness. Because the blood vessels are more permeable, fluid leaks from them and accumulates in surrounding tissue, resulting in swelling at the site. The swelling places pressure on nerve endings, resulting in pain.

CLINICAL JUDGMENT MEASUREMENT MODEL

Recognize Cues: Assessment of Inflammatory Response

The cognitive skill of recognizing cues requires the nurse to collect patient data from health assessments, the environment, and health records, and identify abnormal findings.

A nurse assessing a patient who has a suspected infection will consider findings related to an inflammatory process, such as increased body temperature, heat at the site, redness, or swelling. Additional assessment data gathered should include physical history, degree of pain, loss of function, and lab levels that indicate infection, such as an increased white blood cell count.

A **fever** can be one of the body's responses to pathogens that cause inflammation; it is defined as a rise in core body temperature and is a component of the inflammatory response extended past the localized site. A low-grade fever is a natural immune response and defense mechanism; many providers will not initiate pharmacological interventions until it rises above 102°F (38.9°C). After all, a fever enhances the nonspecific immune defenses by stimulating an increase in white blood cells (WBCs). WBCs are produced in the bone marrow and are an essential part of the immune system as their function is to find, fight, and destroy infection within the body. If WBCs are elevated, this can indicate an immune response from the body and demonstrate actively fighting a disease. The rise in temperature can also prevent the growth of many pathogens and can trigger specific immune responses.

Immune Response

In contrast to a nonspecific immune response, specific acquired immunity occurs when an individual's immune system acquires antibodies from a different source. In other words, this type of immunity provides a targeted response to a specific pathogen and can be acquired either actively or passively. The main function of the immune system is to recognize self from nonself and initiate a response accordingly. An **antigen** is anything the immune system recognizes as a foreign object or substance and subsequently initiates formation of antibodies. Immunoglobulins, or **antibodies**, are proteins created in the body in response to an antigen in order to fight the identified substance or toxin.

When a pathogen enters the body and **active immunity** occurs, antibodies form to help protect the body from that pathogen. In subsequent invasions from that same pathogen, the body is able to respond rapidly to the antigen. Active immunity can be acquired through infection, such as with chicken pox, or artificially, through immunizations. The result of antibodies being passed from one person to another is **passive immunity**. This can occur naturally through the placenta or breastfeeding, or it can occur artificially through injections of serums or blood products that contain antibodies.

LINK TO LEARNING

As part of its mission to promote health and prevent disease, the CDC publishes written recommendations for vaccinating U.S. children and adults (https://Openstax.org/r/77recvaccine).

6.2 Asepsis and PPE

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Define the two types of asepsis
- Recognize the negative implications healthcare-associated infections have on healing
- Correlate appropriate personal protective equipment with their necessary uses

Nurses in all roles are in a unique position to create a safe patient care environment. From bedside nurses to executives, fostering safe healthcare environments can prevent the transfer of pathogens and the spread of infection. With evidence-based practices, nurses can facilitate a patient's plan of care and recovery while minimizing risks and complications related to infections. Proper use of infection-control measures can directly affect patient morbidity and mortality.

Asepsis

The state of being free from disease-causing contaminant is referred to as **asepsis**. These contaminants include bacteria, viruses, fungi, and parasites. The term *asepsis* can also refer to the process of preventing infection by minimizing the number of contaminants present and decreasing the ability to transport pathogens. The two types of asepsis include medical and surgical (Table 6.3). Furthermore, medical asepsis has three degrees: sanitization, antisepsis, and disinfection. An example of sanitization is physically removing microorganisms by cleaning linen. An example of antisepsis would be preoperative skin cleansing. Disinfection kills microorganisms on objects such as tables or blood pressure cuffs that come into contact with the patient or patients. This process utilizes strong chemicals called disinfectants, which should not be used on skin.

Medical Asepsis	Surgical Asepsis
Referred to as "clean technique"	Referred to as "sterile technique"
Reduces number of pathogens	Eliminates all pathogens
Used in administering: • Medications • Enemas • Tube feedings • Daily hygiene	Used when performing: • Dressing changes • Catheterizations • Surgical procedures

TABLE 6.3 Types of Asepsis

Medical Asepsis

The techniques and procedures used to decrease the potential for the spread of microorganisms and infection is called **medical asepsis**. Medical asepsis is also referred to as "clean technique" in the healthcare environment because it is a standard practice used to avoid spreading infection from one person to another throughout a facility. The core practices of medical asepsis include hand hygiene, environmental cleanliness, and the use of protective equipment and isolation.

Surgical Asepsis

The absence of all microorganisms within any type of invasive procedure is called **surgical asepsis**. Maintaining surgical asepsis requires the use of sterile technique, a set of specific practices and procedures that are performed to make an environment and equipment in that environment free of all microorganisms. Principles of sterile technique help control and prevent infection. Sterile technique is discussed in depth in 6.3 Sterile Technique.

Hand Hygiene

The term hand hygiene refers to the act of handwashing, hand rubbing (using alcohol-based hand sanitizer), or surgical hand antisepsis. Hand hygiene is regarded as one of the most important elements in the prevention and control of infections. Hand hygiene that is timely and effective protects patients, healthcare workers, and the

healthcare environment from the spread of infection. Hand hygiene should be performed when arriving and leaving a patient care unit, before direct contact with a patient, before and after removing gloves, after contact with patient's skin, and when hands are visibly dirty or soiled with blood or bodily fluids. Healthcare providers may be required to wash their hands as many as 100 times in a twelve-hour shift, depending on the number and acuity of patients.

LINK TO LEARNING

The World Health Organization has created the Five Moments of Hand Hygiene (https://Openstax.org/r/775momenthand) to help healthcare workers improve understanding of hand hygiene and the five moments when it is required.

Cleaning hands using an alcohol-based sanitizer is an effective form of hand hygiene if the hands are not visibly soiled. The advantages of alcohol-based hand hygiene are that it takes only twenty to thirty seconds, can be completed directly at the point of care, and does not require a sink, water, or towel. Alcohol-based hand sanitizers can kill most pathogens. Keep in mind, however, that certain bacteria are not removed by hand sanitizers. These bacteria are only removed by handwashing. One example of bacteria that is only removed with soap and water is *Clostridioides difficile* (*C. diff*). Nurses who take care of patients with *C. diff* or other stubborn bacteria will usually be told before they commence care. When these instances occur, the nurse will know to avoid the hand sanitizer and choose to wash their hands with soap and water instead. When in doubt, washing your hands is the best choice.

Washing hands with soap and water is recommended if the hands are visibly dirty, soiled, or are contaminated with blood or other bodily fluids. It is essential to spend the proper amount of time on handwashing; washing hands for at least thirty seconds removes up to ten times the number of bacteria as does washing for fifteen seconds.

PATIENT CONVERSATIONS

Understanding When to Use Soap and Water for Hand Hygiene

Scenario: The nurse is entering a patient's room to complete q4h vital signs. This patient is currently positive for *Clostridioides difficile*. After donning personal protective equipment, the nurse enters the room.

Nurse: Hi, Ms. Lee, it's your nurse Bryan. I'm here to get your vital signs. Let me wash my hands, and we will get started. How are you feeling?

Patient: I'm doing okay, I suppose. I'm not in any pain right now, so that's good news.

Nurse: That's excellent. Let me just put on a pair of gloves, so I can verify your name on your wristband. Can you tell me your name, date of birth, and if you have any allergies?

Patient: Yang Lee, 03/27/1942. I'm allergic to iodine. Why did you wash your hands when you came in here when there's hand sanitizer over by the door?

Nurse: Performing proper hand hygiene is a critical component of preventing the spread of infections, especially in the hospital. Alcohol-based hand sanitizers are a great method for cleaning your hands, but there are times when it is not effective.

Patient: Is getting my vital signs one of those times?

Nurse: The stool sample that was sent to the lab on Monday came back positive for a bacteria called *Clostridioides difficile*, or *C. diff*. Alcohol alone cannot kill *C. diff* spores, and studies have shown soap and water to be much more effective at removing them. In order to prevent the spread of infection, you'll notice that all of the healthcare workers will be washing their hands with soap and water when they enter and exit your room.

Patient: So, should I wash my hands too?

Nurse: Since you already have *C. diff*, you cannot infect or re-infect yourself. However, washing your hands will prevent you from getting bacteria such as *C. diff* in the future. Additionally, washing your hands will help prevent

spread to others inside and outside of the hospital. Nurses always wash our hands frequently because it washes away all kinds of bacteria. It really is the best way to prevent spreading bacteria.

Patient: That makes sense. I wouldn't want anyone else to get sick from what I have. Thank you for being so careful.

Healthcare-Associated Infections

Healthcare-associated infections (HAIs), also known as nosocomial infections, are infections acquired while receiving medical treatment in a healthcare facility. Although preventable, HAIs are some of the most common complications for patients within a healthcare setting and can prolong hospital stays and recovery time. According to the CDC, one in every twnty-five hospitalized patients will contract an HAI (CDC, 2022). The most common HAIs are associated with invasive devices such as catheter-associated urinary tract infections (CAUTIs), central line–associated bloodstream infections (CLABSIs), ventilator-associated pneumonia (VAP), and surgical site infections (SSIs).

The risk for developing an HAI is dependent on the infection-control policies within a facility and the degree of adherence to them. Additional risk factors include a patient's immune status, age, underlying comorbidities, and the prevalence of pathogens within the environment. Length of hospitalization, number of invasive procedures, and amount of antibiotic therapy received all increase a patient's risk for acquiring an HAI.

LINK TO LEARNING

The Global Alliance for Infections in Surgery has outlined seven strategies to prevent healthcare-associated infections (https://Openstax.org/r/77prevtinfect) in the healthcare setting.

Preventing Healthcare-Associated Infections

Nurses are at the front line for preventing the transmission of pathogens through infection-control policies and procedures. These evidence-based prevention strategies and control practices can directly reduce HAIs. Appropriate hand hygiene and glove usage heavily contributes to an increase in patient safety and the prevention of HAIs. Keeping a healthcare environment clean by disinfecting equipment between patients is an additional vital prevention measure. Additionally, the use of proper personal protective equipment can prevent the transmission of pathogens. Nurses must stay current with how to protect themselves from newly identified pathogens and adhere to the protocols put in place. In recent history, viruses such as Ebola and the coronavirus that caused the COVID-19 pandemic all required specific infection-control measures. Healthcare providers were and still are on the front lines in these instances and must also educate the public and their patients about necessary protocols.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety: Preventing HAIs

Definition: Quality and Safety Education for Nurses (QSEN) competencies were designed to emphasize key elements that pre-licensure nursing students should be competent in at the time of graduation. Safety is defined as minimizing risk of harm to patients through both systems effectiveness and individual performance.

Knowledge: Students will examine human factors and other basic safety design principles as well as commonly used unsafe practices, using evidence-based sources to enhance knowledge.

Skills: Students will demonstrate effective use of strategies to reduce risk of harm to self or others.

Attitudes: Students will value their own role in preventing errors and reducing the spread of infections.

Clinical scenario: A new nurse is working on a medical-surgical unit. Bedside shift report is beginning, and the nurse notices a sign on one patient's door stating that the patient is on airborne precautions. The box of masks located outside the patient's room is empty.

Step 1: The nurse uses *knowledge* to recognize that the patient's condition warrants airborne precautions and that

masks are the first line of defense for reducing the spread of airborne pathogens. The nurse uses knowledge of evidence-based sources to confirm that entering the room without a mask would place themselves and other patients on the unit at risk for exposure to the identified pathogen.

Step 2: The nurse identifies the *skill* of replacing the empty box before anyone can enter the room as an effective use of infection-control strategies to reduce risk of harm to self or others.

Step 3: The nurse stops and replaces the supplies outside the patient's room before continuing with the morning report. The nurse can now begin the shift with a positive *attitude*, knowing value is placed on their role in reducing the spread of infection and providing quality, competent nursing care.

Reporting Healthcare-Associated Infections

As part of its mission in healthcare safety, the CDC has developed the National Healthcare Safety Network (NHSN), the nation's most widely used system for tracking and surveillance of HAIs (CDC, 2022). More than 38,000 healthcare facilities provide data to the NHSN, which are, in turn, used for analysis and development of prevention initiatives by states, regions, and national public health agencies. These agencies include acute care/critical access hospitals, long-term care facilities, ambulatory surgery centers, long-term acute care facilities, inpatient psychiatric facilities, inpatient rehabilitation facilities, and dialysis facilities. The report provides data on CLABSIs, CAUTIs, ventilator-associated events (VAEs), SSIs, methicillin-resistant *Staphylococcus aureus* (MRSA) bloodstream events, and *C. diff* events. Federal government bodies such as the Centers for Medicare and Medicaid Services (CMS) use these data to determine performance incentives. Community members can use this information to select the healthcare facilities that they feel best fits their needs.

Personal Protective Equipment

Healthcare workers use **personal protective equipment (PPE)** as a means of barrier protection for their eyes, nose, mouth, and skin from exposure to blood and other potentially infectious bodily fluids and materials. The most commonly worn PPE includes gloves, gowns, face masks, protective eyewear, and face shields. These barriers are used in both standard precautions as well as in transmission-based precautions. Every nurse must be knowledgeable about the appropriate PPE to wear in various situations. Simply wearing all available PPE is not appropriate practice and is wasteful considering healthcare resources.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Initiating the Use of Additional Personal Protective Equipment

This scenario requires a nurse to take action to prevent infection from spreading. A nurse is reviewing a patient's morning laboratory results. The nurse notes that the patient's stool culture has come back positive for vancomycin-resistant *Enterococci* (VRE). Knowing the method of transmission of VRE (contaminated equipment, surfaces, hands), the nurse analyzes these data and prioritizes how they will be incorporated into the patient's care. The nurse knows that additional interventions will need to be implemented.

The nurse hangs a contact isolation sign on the door and places a PPE cart next to the room. The cart contains masks, gloves, face shields, hand sanitizer, and disinfectants, among other PPE items. When the nurse enters the patient's room, they don the appropriate PPE per facility policy. They also provide the patient with education regarding why they will be seeing staff wearing additional PPE.

Gloves

The use of gloves in the healthcare setting prevents contamination of the hands and reduces the likelihood of the transmission of pathogens (Figure 6.5). Medical gloves should be worn when providing care to protect the healthcare provider as well as the patient. Further, sterile gloves should be worn for procedures that pose greater risk of contamination to the patient, which are indicated as sterile procedures. Gloves are only effective in infection prevention if they are used properly, and the wearer performs proper hand hygiene before and after wear. Gloves should be removed and hand hygiene should occur once contact with blood or bodily fluids has ended, once contact with a single patient has ended, when leaving a patient's room, and when there is a need for hand hygiene. The same pair of gloves should never be worn more than once.

FIGURE 6.5 Donning nonsterile gloves in a healthcare setting is one of the most effective ways to prevent infection. (credit: "13550," by Amanda Mills/Centers for Disease Control and Prevention, Public Domain)

Gowns

A **medical isolation gown** is a long-sleeved garment that covers the body front and back from the neck to the thighs, overlaps or meets in the back, fastens at the neck and waist, and is easy to put on and take off. They are used in the healthcare setting as a broad barrier against blood or bodily fluids. Gowns are used for patients who are on contact and droplet precautions and for any potentially splash-generating procedures. Medical isolation gowns must be removed before leaving an individual patient area and hand hygiene must occur. A **surgical gown** is worn by healthcare personnel during a surgical procedure to protect both the patient and the personnel from transmission of pathogens. Examples of gowns can be seen in Figure 6.6.

(a) (b)

FIGURE 6.6 Multiple styles of gowns may be available within a healthcare setting. (a) Medical and (b) surgical isolation gowns can be worn with additional forms of PPE such as masks, gloves, goggles, and shoe covers. (credit a: "Call to Service: Army psychologist on the COVID-19 battlefront" by unknown, Public Domain; credit b: "USMC-080618-M-0884D-002.jpg" by Sgt. Rocco DeFilippis, Public Domain)

Masks

Healthcare workers should wear a mask when caring for a patient on droplet precautions or when providing care to patients who are immunocompromised. A **surgical mask** is worn over the nose and mouth to prevent the transmission of large particle droplet matter generated through coughing or splash-generating procedures. These masks have either ear loops or ties and can be either pleated or made of molded material. An **N95 respirator mask** is a tight-fitting cover that, when properly fitted, protects the wearer from very small particles that float in the air, such as tuberculosis (TB), measles, chickenpox, and COVID-19 (Figure 6.7). When properly worn, an N95 mask can block at least 95 percent of non-oil-based particles that are 0.3 microns or larger. Any time a mask becomes wet from exhaled moist air, it weakens the integrity of the mask, warranting a mask change.

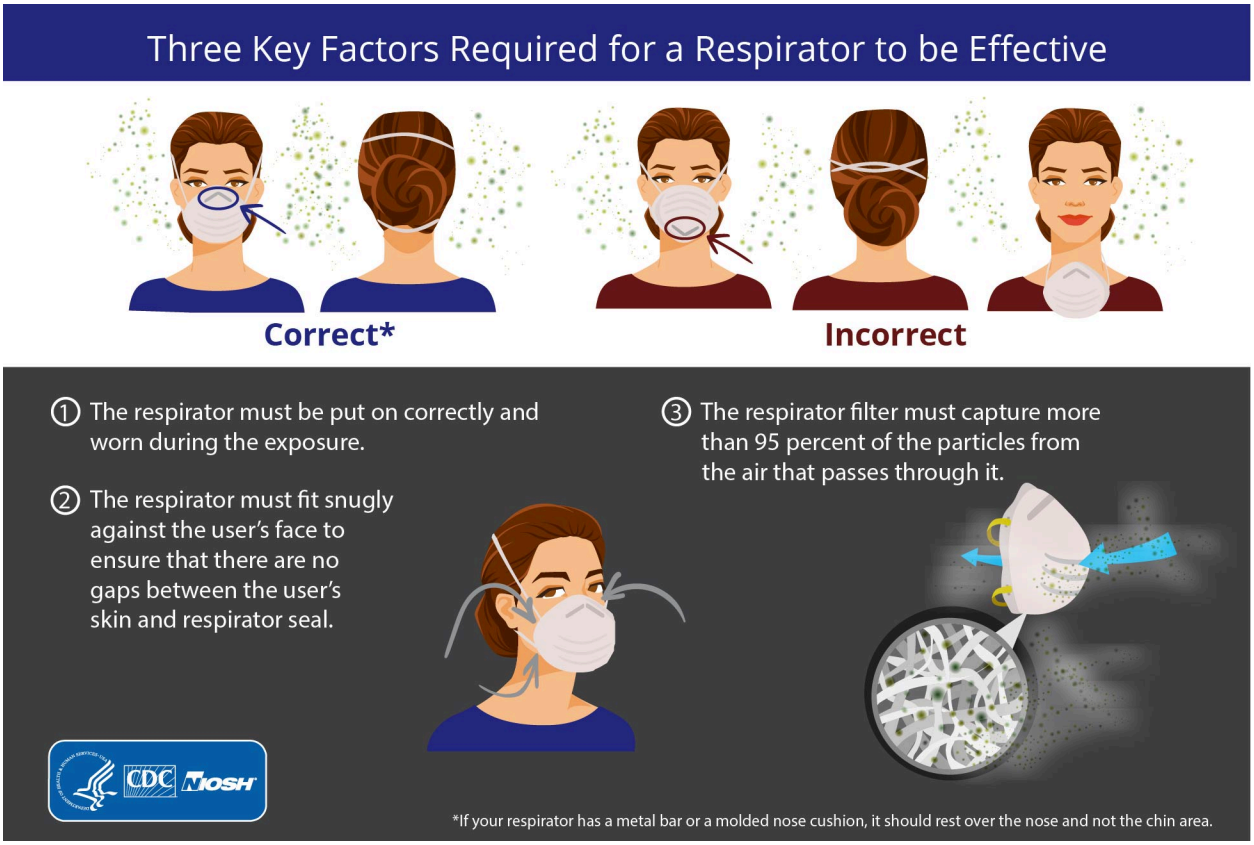

FIGURE 6.7 While the N95 respirator can be highly effective at stopping particles from passing through, it must fit tightly on the wearer's face and must be donned and doffed properly in order to provide optimal protection. (credit: modification of "Three Key Factors Required for a Respirator to be Effective" by Centers for Disease Control and Prevention, Public Domain)

Eyewear and Shields

The use of eyewear and shields form a barrier and protect the membranes of the eyes, nose, and mouth when performing tasks that could produce splashes of bodily fluids or blood. Goggles should fit snugly around the eyes and protective face shields should cover the entire forehead, extend past the chin, and wrap around the sides of the face (Figure 6.8).

(a) (b)

FIGURE 6.8 (a) Goggles and (b) face shield add protection for healthcare providers. These can be worn with additional PPE, while considering placement and appropriate use of each item. (credit a: "CCP treats 1st hospitalized, COVID-positive GAFB member" by Senior Airman Abbey Rieves, Public Domain; credit b: "UAMTF 352-1 assists Philadelphia health care workers" by U.S. Army photo by Pfc. Joshua Cowden, 22nd Mobile Public Affairs Detachment, Public Domain)

Donning PPE

The type of PPE used in a healthcare setting is based on the level of precaution and isolation that is required. The meticulous use of PPE is a vital step to reduce contamination and transfer of infectious diseases. The CDC recommends a standardized procedure for donning, or applying, PPE, but the procedure should always be tailored to the specific type of PPE being used. Prior to donning PPE, always perform hand hygiene. The steps for donning PPE should follow the guidelines outlined by the CDC.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Donning Personal Protective Equipment, Evidence-Based Practice

Definition: Quality and Safety Education for Nurses (QSEN) competencies were designed to emphasize key elements that pre-licensure nursing students should be competent in at the time of graduation. Employing evidence-based practice means "integrating best current evidence with clinical expertise and patient/family preferences and values for delivery of optimal health care."

Clinical scenario: Here are some evidence-based steps issued by the CDC (n.d.) on donning PPE:

Step 1: An isolation gown should be donned first. The gown should be picked up by the shoulders, which allows it to fall open without touching the floor. The gown should be positioned to fully cover the torso (from the neck to the knees) and arms (to wrists), and it should wrap around the back. Fasten the ties at the neck and the waist.

Step 2: After securing the gown, don the face mask or N95 mask. Ensure that the ties or elastic band fits at the middle of the head and neck. The mask should be snug to the face and below the chin. N95 masks should be fit checked to ensure proper seal.

Step 3: Once the face mask is in place, goggles will be placed over the top of the edge of the mask. A face shield is placed over the eyes.

Step 4: The final step for donning PPE is the application of gloves. The glove cuff should extend over the gown cuff. Ensure that the correct size gloves are selected to prevent them from falling off or ripping.

Doffing and Disposal of PPE

Once patient care is completed, all PPE except for a respirator will be removed, or doffed, prior to exiting a patient's room. All PPE is discarded in the appropriate receptacle as outlined by facility policy. Following the removal of PPE, perform hand hygiene immediately. The steps for doffing PPE should follow the guidelines outlined by the CDC.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Hand Hygiene and Donning and Doffing PPE

See the competency checklist for Hand Hygiene and Donning and Removing PPE. You can find the checklists on the Student resources tab of your book page on openstax.org.

6.3 Sterile Technique

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the different levels of clean and how to achieve each
- Recall common methods of sterilization and disinfection in the healthcare setting
- Demonstrate the different principles of sterile technique

Environmental cleanliness is a foundational concept in nursing. Maintaining a clean environment is essential for preventing infectious disease and the spread of HAIs. In the absence of a properly cleaned environment, the acts of handwashing and donning PPE are substantially less effective in the spread of infection and transfer of pathogens. Nurses must recognize which items in the healthcare environment should be cleaned as well as the proper way this cleaning should be done. They must also be able to identify when an item is contaminated and the proper steps that

must be taken for disposal or sterilization. Agency policies, along with governmental guidelines, will help nurses seeking specific answers to these questions.

Levels of Clean

For the chain of infection (see Figure 6.2) to be broken, it is critical that nurses comprehend the proper knowledge and resources for how to clean their environment. To minimize the risk of transmission of infection, there are three levels of cleanliness, in increasing degrees of purity, that specify how specific objects and items should be cleaned: sanitization, disinfection, or sterilization. The concepts of asepsis discussed in 6.2 Asepsis and PPE provides a strong foundation for the three levels of cleanliness.

Sanitization

The removal of visible soil from objects and materials using water with detergents or products that are enzymatically formulated to inhibit microbial growth is called **sanitation**. Sanitation and cleaning coincide with the goal of medical asepsis, which is to keep all employee and patient-care areas free of debris and contamination. All items must first be cleaned before they can be disinfected or sterilized.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Surgical Hand Scrub and Gloving

See the competency checklist for Surgical Hand Scrub and Gloving. You can find the checklists on the Student resources tab of your book page on openstax.org.

Disinfection

The process of **disinfection** removes microorganisms and disease-causing pathogens from inanimate objects. This process is completed on both semicritical and noncritical items. Semicritical items include items that have contact with mucous membranes or nonintact skin. Examples of these types of items include reusable devices, such as endoscopes and respiratory therapy equipment. Noncritical items have contact with skin but not mucous membranes. Because of this, they do not carry a high risk of infection transmission. Examples of these items include stethoscopes, blood pressure cuffs, and bed linens.

Sterilization

The process of **sterilization** is a procedure that eliminates all microorganisms and spores in or on an object. Critical items require sterilization due to their high risk for infection if they are contaminated. Examples of this include all surgical instruments, catheters, needles, and chest tubes.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Use of an Autoclave

A tool that nurses may use in a healthcare setting is an autoclave (Figure 6.9). Autoclaves use high-pressure steam for a designated amount of time to kill pathogens on objects of various shapes and sizes. Common examples are surgical tools, lab instruments, and pharmaceutical objects. Nurses may have various roles in sterilization dependent upon their healthcare setting. Nurses in an outpatient office setting may be responsible for the entire sterilization process, while in contrast, in a surgical setting there may be technicians who complete this process. Nurses must be aware of their specific responsibility in sterilization and develop those skills accordingly.

FIGURE 6.9 An autoclave can sterilize reusable instruments. (credit: "Autoclave," by Tom Beatty/Flickr, CC BY 2.0)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Sanitizing Instruments

See the competency checklist for Sanitizing Instruments. You can find the checklists on the Student resources tab of your book page on openstax.org.

Methods of Sterilization and Disinfection

The process of disinfection is carried out by using chemical disinfectants. While some chemicals may have a broad spectrum of effectiveness, those that have a narrower spectrum are typically easier to use and less toxic. Common chemicals used as disinfectants include alcohol, hydrogen peroxide, and chlorine. Sterilization can be done by both physical and chemical methods, or a combination of both.

Physical

The process of physical sterilization within a hospital uses large equipment, such as autoclaving with steam. The steam heats up to 250 to 273°F (121 to 134°C) and inactivates all fungi, bacteria, viruses, and bacterial spores. Steam sterilization is the most common form of physical sterilization used in hospitals. Heat can also be used to sterilize by heating, flaming, incineration, boiling in water, and dry heat.

Chemical

Chemical sterilization uses products, such as ethylene oxide, concentrated bleach, and formaldehyde. This type of sterilization is typically used for instruments, such as those containing rubber, plastic, or glass, that could not tolerate high heat temperatures and/or humidity.

LINK TO LEARNING

In May 2022, the World Health Organization released a Global Strategy on Infection Prevention and Control (https://Openstax.org/r/77globalprevn) to promote the prevention of infections in all healthcare settings.

Principles of Sterile Technique

A **sterile technique** is the use of practices and procedures that inhibit microorganisms in a specific environment and prevent contamination. This technique is an essential element for patient safety, and it is vital that all nurses

understand the principles of the skill. Sterile technique is most commonly practiced in operating rooms and during special procedures, diagnostics, and labor and delivery. It is also used at the bedside for sterile procedures, such as the insertion of chest tubes, central venous lines, and indwelling urinary catheters.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Preparing for Sterile Technique, Evidence-Based Practice

Definition: Quality and Safety Education for Nurses (QSEN) competencies were designed to emphasize key elements that pre-licensure nursing students should be competent in at the time of graduation. Employing evidence-based practice means "integrating best current evidence with clinical expertise and patient/family preferences and values for delivery of optimal health care."

Sterile technique entails using evidence-based practices and procedures to minimize pathogens and deter contamination in a healthcare environment. Student nurses must know these practices, as recommended by governmental bodies and healthcare-setting policies. Students must demonstrate effective use of sterile technique to reduce risk of harm to self or others.

Clinical scenario: Prior to initiating sterile technique, the nurse must take several critical steps to ensure sterility:

Step 1: Always perform hand hygiene before initiating any sterile procedure.
Step 2: Ensure all working surfaces remain clean and dry.
Step 3: Verify you have all supplies that are needed and that they are within the expiration date.
Step 4: Keep all supplies in reach to prevent them rubbing against things or dropping.
Step 5: Bring a second pair of sterile gloves in the event of a break in sterility.

Opening a Sterile Package

Remove any paper or plastic layer that is used to form a barrier between the work surface and inner wrapper. Inspect the package to ensure that it is intact and within the expiration date. To open a sterile package, lay it on a clean and dry surface so that the flaps are facing up, and the top flap is pointed down (forming an upside-down triangle like an envelope). The outside of the package is unsterile as is the 1 in (2.5 cm) border of the package.

LINK TO LEARNING

Proper technique when preparing a sterile field is critical in order to provide safe care to patients during procedure. Lecturio Nursing has put together a video that describes how to open a sterile kit (https://Openstax.org/r/77sterilekit) that reviews this skill.

Applying Sterile Gloves

Clean gloves are different from **sterile gloves** because with sterile gloves the sterilization process is completed by the manufacturer; they are free from microorganisms and are individually packaged as a pair to remain free of pathogens. Prior to applying sterile gloves, determine your size. The gloves should fit snugly but not tightly. Place the glove package on a clean and dry surface. Using the outside flaps that form the 1 in (2.5 cm) border, open the glove package so that the cuffs are closest to you. Using your nondominant hand, pick up the opposite glove, touching only the inner cuff (the part that will touch skin). Keeping the hand flat and the thumb tucked in, slide your dominant hand into the glove, being careful not to lower hands below the waist (Figure 6.10). Using the gloved hand, slip your fingers into the cuff of the remaining glove. Lift the glove up and away from the table. Slide your nondominant hand into the glove. Keep the gloved thumb up and back to prevent it from touching bare skin. Once both gloves are on, you can adjust to fit fingers as needed. Keep hands above the waist and within the visual field to avoid breaking sterility.

FIGURE 6.10 Be sure to only touch the cuff of a sterile glove while donning. (credit: "5727" by Kimberly Smith and Christine Ford/Centers for Disease Control and Prevention, Public Domain)

Preparing and Maintaining a Sterile Field

In order to maintain a sterile field, it is critical to follow several protocols. The nurse must always be able to see the field. This means that if you turn your back and can no longer see the field, sterility is broken. Do not reach over the sterile field; even after donning sterile gloves, your arms and sleeves are not sterile. Be aware of any stethoscopes or bandages that may hang into the field, breaking sterility. Any sterile object that is held below the waist is considered nonsterile, including a sterile-gloved hand. Any objects that become wet are no longer considered sterile due to the ability for bacteria to grow rapidly in a wet environment.

Pouring Sterile Solutions

Part of a sterile field may include the use of sterile solution. In order to pour a sterile solution, healthcare providers must follow several steps to avoid breaking sterility. Note first that a solution is sealed and unexpired. Sterile solutions should be poured 6 in (15 cm) away from the field into a sterile bowl or tray from the side of the sterile field, not directly over it. Pour solutions slowly to prevent splashing.

LINK TO LEARNING

As with all aspects of a sterile field pouring sterile solutions (https://Openstax.org/r/77poursterile) should be done following appropriate technique.

6.4 Infection Control and Patient Safety

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify how the nurse can promote patient safety through infection control
- Recognize important principles when dealing with multidrug-resistant organisms
- Verbalize steps the nurse can take to prevent occupational exposure

Healthcare organizations are required to meet quality and safety needs for patients, staff, and visitors. An organization's stated commitment to a culture of patient safety can directly enhance infection prevention. The goal of infection prevention is to decrease the risk of infection to patients and healthcare personnel, identify and correct problems that are recognized as deterrents to infection prevention, minimize risks associated with procedures, and maintain compliance with hospital and governmental policies associated with infection prevention. The CDC has recognized the urgent issue of microorganisms that are resistant to drugs and the immediate need for intervention. Furthermore, the American Nurses Association promotes safeguarding antibiotics and the integration of a comprehensive approach to preventing inappropriate use.

Maintaining Patient Safety through Infection-Control Measures

The role of nursing in patient safety and infection prevention is significant. Nurses provide care at the bedside and have the direct ability to impact care and influence positive patient outcomes by helping to identify and prevent the spread of infectious agents. The interventions implemented by a nurse have an integral role in infection prevention. Nurses are part of the team responsible for executing appropriate isolation protocols, modeling infection-control measures, monitoring others for safe practice, identifying barriers to appropriate practice, and educating patients and other interdisciplinary team members as needed. Specific protocols for isolation and infection control will depend on several factors including mode of transmission, environmental circumstances, and available resources.

Standard Precautions: Tier 1

The first tier of precautions to protect healthcare staff and patients from infection are **standard precaution**s. These precautions apply to all patients, regardless of their diagnosis or presumed infection status. The components of standardized precautions include hand hygiene, respiratory hygiene, cleaning and disinfecting, personal protective equipment, safe injection practices, needlestick and sharps injury prevention, and waste disposal.

Transmission-Based Precautions: Tier 2

In situations where standard precautions are not adequate to prevent infection transmission, **transmission-based precautions**. These types of precautions are specific to infections and should be implemented immediately following patient presentation of signs and symptoms specific to certain infections. These precautions fall into the categories of airborne, droplet, and contact. Transport for patients who are under transmission-based precautions should be limited and only done when essential.

PATIENT CONVERSATIONS

Mental Health Needs for Patients on Isolation Precautions

Scenario: The nurse is entering a negative pressure airborne isolation room. The patient has a diagnosis of pneumonia and has tested positive for COVID-19. The nurse recognizes that the patient breakfast tray is sitting on the bedside table, uneaten.

Nurse: Hi, Mr. Garces. How are you feeling? Were you not hungry this morning?

Patient: (not looking at the nurse) I was . . .

Nurse: It there something wrong? Are you feeling nauseous?

Patient: No. I was hungry, but when my breakfast tray got here, it was very cold. It must have sat outside the door for a while before the tech brought it in. I feel like everyone forgets about me since I'm stuck in this room.

Nurse: I'm so sorry to hear that happened. I will call down to dietary right now to get a new hot tray sent up. I

understand being sick and in an isolation room can be difficult. Do you want to talk about how you are feeling?

Patient: It's just really lonely in here. I don't want my family to come visit me and get sick. But I miss talking to them.

Nurse: I see you have your cell phone on the nightstand. Have you been able to call them?

Patient: No, I forgot my phone charger at home, and the battery ran out days ago.

Nurse: We have an extra charger at the nurse's station I can bring in. It is very important to be able to stay in contact with loved ones and have someone to talk to. Technology has made that a lot easier these days.

Patient: That would be great and mean a lot to me. Thank you.

Airborne Precautions

When a patient is known or suspected to be infected with pathogens that are transmitted through droplet nuclei, **airborne precautions** should be used. Patients on airborne precautions, such as those being treated for chicken pox or measles, should be placed in negative pressure rooms. If a negative pressure room is unavailable, the patient should be masked and placed in a private room with the door closed. The PPE for airborne isolation includes the use of a fit-tested NIOSH-approved N95 or higher-level respirator. If transport outside of the room is necessary, patients must wear an N95 mask. These precautions prevent the pathogen from gaining access to the hospital's ventilation and possibly infecting other patients.

Droplet Precautions

The use of **droplet precaution**s are implemented when patients are known or suspected to be infected with pathogens transmitted by respiratory droplets from coughing, sneezing, and talking. Patients in acute care should be placed in a single patient space. The PPE needed when treating patients in droplet isolation includes donning a mask upon entering a room and discarding it before exiting the room. If transport outside of the room is necessary, patients must wear a surgical mask.

Contact Precautions

The use of **contact precautions** are indicated for patients who have known or suspected infections that can be transmitted through direct skin-to-skin contact or indirect contact with environmental surfaces or equipment. Patients in acute care should be placed in a single patient space. The PPE needed when treating patients in contact isolation includes gloves and an isolation gown whenever touching the patient, discarding them before exiting the room. Disposable or dedicated patient equipment should be used for the patient. When it is unavoidable to utilize common use equipment, ensure that it has been properly cleaned and disinfected before use on another patient. (Figure 6.11) provides a quick guide comparing contact, droplet, and airborne precautions.

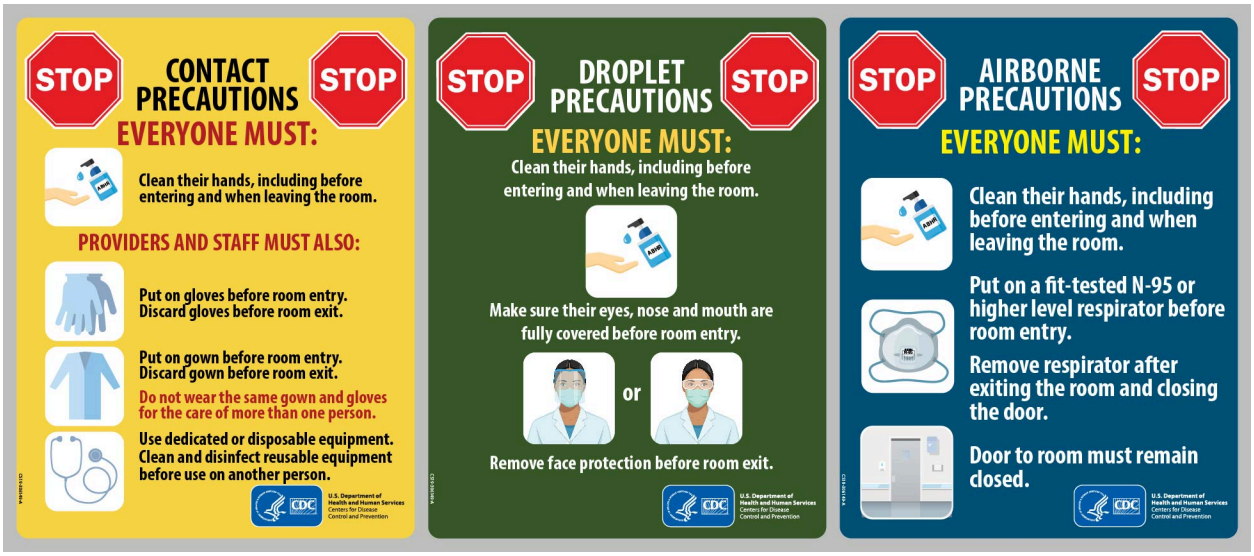

FIGURE 6.11 Understanding the aspect of (a) contact, (b) droplet, and (c) airborne precautions is vital for nurses to provide safe and effective care. (credit: modification of "Contact Precautions," "Droplet Precautions," and "Airborne Precautions" by Centers for Disease

Control and Prevention, Public Domain)

Dealing with Multidrug-Resistant Organisms

The impact of HAIs extends past the individual patient level. At the community level, it has been linked to the development of multidrug-resistant infections. In other words, many HAIs are caused by **multidrug-resistant organisms** (MDROs), which are bacteria that have become resistant to certain antibiotics, so much so that these antibiotics can no longer be used to control or kill the bacteria.

Examples of MDROs include *Clostridioides difficile*, methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococci* (VRE), and multiresistant gram-negative bacilli. HAIs that are caused by antibiotic-resistant bacteria are of particular concern, because they are typically difficult to treat and pose a significantly higher risk for severe illness and complications.

LIFE-STAGE CONTEXT

Susceptibility to Infection

The overall misuse and overuse of antibiotics has created a risk of MDROs to all populations, yet older adults have increased risk. Older adults tend to spend more time in hospitals and/or long-term care facilities with more chronic conditions, which increases exposure to different pathogens. Furthermore, age-related physiologic changes decrease immune system efficiency, thus increasing vulnerability to such infections.

Nursing Advocacy for Patient Safety

Nurses in all disciplines have the responsibility to ensure patients are receiving the safest care. Health care today is more complex than ever, and patients have more complex needs and conditions. Progress in treatments means more extensive intervention, prevention, monitoring, and care. By advocating for wellness and safety for patients, nurses can contribute to high-standard working environments with improved regulations and patient-centered policies. Safer healthcare environments lead to positive patient outcomes. Education is another consideration in the role of an advocate. Nurses often are the ones educating patients and/or their families on specific care needs, as well as how to navigate the healthcare system as a whole. Adjusting for specific needs and learning styles of the patient/family is critical to provide effective education. Nursing advocacy demonstrates an increased level of investment in safety by taking the extra time to meet the needs of the patients.

REAL RN STORIES

Advocating for Proper PPE Use

Nurse: Shiela, BSN
Clinical setting: Medical oncology unit
Years in practice: 15
Facility location: Buffalo, New York

Five years ago, I began working as the charge nurse on a medical oncology unit. I'm very involved in the care of all the patients on the unit and attend rounds daily. I provide a listening ear and discuss with patients how their treatment is going. One day during my rounds, I had a patient's daughter voice several concerns.

This particular patient was on contact isolation, and healthcare workers were required to don PPE before entering the room. The patient's daughter stated that several nurses, nursing assistants, and therapists had entered the room without wearing any PPE. I acknowledged the daughter's concerns and promised to investigate what was happening.

After discussions with the staff, I learned that the issue was multifaceted. Several of the assistants did not understand what PPE was required, so I provided proper education. Other staff members stated that the floor was frequently out of PPE and that they did not have time to search the hospital. I assured the staff that I would speak to the supply chain to ensure that proper PPE was always available; then I reeducated them not to enter isolation

rooms without it. I was able to advocate for the patient's safety by providing needed education for the staff. The issue also brought about an opportunity for me to advocate for staff safety by guaranteeing that the necessary items were available to provide safe care.

Preventing Occupational Exposure

It is vital that healthcare workers are able to recognize and reduce risks associated with exposure to blood, bodily fluids, and biologic hazards. The recent emergence of the previously unknown pathogen COVID-19 highlights the critical need for safety in health care and the increasing importance for protecting against pathogens.

Latex Sensitivity

Latex products are made from a natural rubber, and sensitivity can develop if there is repeated exposure. Individuals in health care wear gloves at a much higher frequency than the general public; the increased exposure places them at a higher risk for developing sensitivity, which could lead to allergy. If a nurse has indicated a sensitivity to latex, alternative products should be used, such as latex-free gloves made of neoprene or vinyl. In addition, such nurses should avoid areas where latex is likely to be inhaled, such as an area of high prevalence in the use of latex gloves. Some symptoms of a latex allergy include itching, rash/hives, sneezing, watery/itchy eyes, skin redness, cough, wheezing, and difficulty breathing. For patients with a latex allergy, prevention is key for good outcomes. All clinicians involved in caring for the patient should be a part of the prevention plan to avoid incidental exposure.

Reducing Risk Exposure

Identifying why and how exposures occur is a critical component to the success of a healthcare prevention program. All healthcare employees must receive proper training and education regarding how to reduce their risk for exposure. Emphasis must be placed on following proper hand hygiene, and proper PPE protocols can greatly reduce risk of exposure. Compliance must also be recognized when removing PPE to prevent contamination. PPE can not only protect the patient but also the nurse providing care to the patient who may be contagious or pose a risk to specific populations. Reducing exposure to toxic medications, such as chemotherapy, and following proper protocols for disposal of medications are important for nurses to understand. Following safety procedures and protocols along with using clinical judgment is the best way for nurses to minimize their risk.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety: Disposing Sharps Safely

Definition: Quality and Safety Education for Nurses (QSEN) competencies were designed to emphasize key elements that pre-licensure nursing students should be competent in at the time of graduation. Safety is defined as minimizing risk of harm to patients through both systems effectiveness and individual performance.

Clinical scenario: Nurses should have the following knowledge and skills regarding disposal of sharps:

- Do not throw a needle or sharp in the trash. Dispose of it in a marked sharps container immediately after use (Figure 6.12).
- Never recap a used needle; lay it down or remove a used needle from a disposable syringe.
- When disposing of a needle in the sharps container, never use force or reach into the container.
- If a needlestick occurs, immediately report the incident, and follow your facility's guidelines and protocols.

FIGURE 6.12 Sharps should always be placed in a marked sharps container after use. (credit: "Sharps Container.jpg" by "The finished Tattoo"/Wikimedia Commons, CC BY 2.5)

Improving Sharps Safety

Sharp injuries are among the top occupational threats to nurses and healthcare workers. Needlestick injuries can occur at any point during the use, disassembling, or disposing of needles. Sharp injuries put workers at risk for blood-borne diseases, such as hepatitis B, hepatitis C, and HIV. Needles that are not disposed of properly can cause injury to any individual who encounters them unexpectedly. The term **sharps** includes needles as well as other objects, such as lancets, razor blades, scissors, clamps, pins, staples, and glass items.

The Needlestick Safety and Prevention Act (2000) made needle safety a top priority in hospitals. It is critical, however, that all healthcare workers are aware of and alert to the dangers associated with sharps. Needlestick safety should focus on education and prevention. All healthcare workers should receive hands-on employee training that focuses on the use, handling, and disposal of all sharps. All sharps do not have the same safety mechanisms. Therefore, hands-on training with the sharps currently being used or those that will be adopted must be a priority to ensure nurse and patient safety. Policies and procedures should be implemented regarding safe disposal of sharps and should include routine evaluation of sharps container access. All containers should be fitted with a tight lid and placed at shoulder height with safety features that reduce exposure to fingers and hands.

Safety Devices

It is recommended that healthcare facilities use needleless systems whenever possible. Needleless systems use adaptors and Luer-locks in conjunction with IV tubing and vials, allowing access through a valve system. When the use of a needleless system is not feasible, safety devices should be put into place. Safety-engineered sharps are devices with a built-in safety feature or mechanism that effectively reduces the risk of needlesticks. Examples of safety-engineered sharps include syringes with guards or sliding sheaths (Figure 6.13), retractable needle systems, and shielded or retracting scalpels.

FIGURE 6.13 Many types of safety mechanisms exist for sharp instruments in health care, including needles with guards. (credit: "231018-F-RI324-1019," by Airman Cade Ellis/Moody Air Force Base, Public Domain)

Summary

6.1 Infection Cycle

By understanding the conditions that foster the spread of infection, nurses can implement evidence-based interventions to break the cycle and stop the chain of infection. Nurses must have a thorough understanding of how to protect themselves and their patients from exposure to harmful pathogens. Nurses should gather the signs and symptoms of infections through examination, patient history, and healthcare records. The infection cycle has six specific phases that all must be completed in order for an infection to matriculate. These six pieces are causative agent, reservoir, portal of exit, mode of transmission, portal of entry, and susceptible host. Breaking this chain at any point can stop the spread of infection. Understanding the various types of immune responses will help nurses to identify infection and initiate treatment. The human body's immune system provides a mechanism for staying healthy through protection against harmful pathogens. An immune response can be classified as either nonspecific, meaning it targets pathogens in a nonspecific manner, or specific, meaning it allows for a high level of adaption and effectiveness against a specific pathogen.

6.2 Asepsis and PPE

Comprehensive knowledge related to infection prevention and control is essential for nurses to protect themselves and patients from the transmission of infection. The two types of asepsis are medical and surgical. Medical asepsis is often referred to as clean technique, while surgical asepsis is often referred to as sterile technique. Understanding the use of personal protective equipment and knowing when to use which type of equipment are key components of infection prevention. By incorporating thorough assessment and applying prevention strategies, nurses are empowered to reduce transmission of pathogens within healthcare environments and the community. One major risk factor to hospital admittance is healthcare-associated infections. The most common HAIs are associated with invasive devices: catheter-associated urinary tract infections (CAUTIs), central line–associated blood stream infections (CLABSIs), ventilator-associated pneumonia (VAP), and surgical site infections (SSIs). These infections often have intensive treatment and compound on the original reason for hospitalization, leading to increased healing time for patients.

6.3 Sterile Technique

Environmental factors play a large role in infection prevention and transmission. Environmental cleaning is a fundamental principle of infection prevention because contaminated equipment and surfaces play a major role in transmission. Improving cleaning practices and increasing compliance reduces the exposure to pathogens and, therefore, reduces incidences of infection. To minimize the risk of transmission of infection, there are three levels of cleaning of which nurses should be knowledgeable: sanitization, disinfection, and sterilization. Moreover, it is critical that nurses understand and utilize the principles of the skill of sterile technique as an essential element of patient safety.

6.4 Infection Control and Patient Safety

Nurses play a critically important role in ensuring patient safety while providing care directly to patients. When standard precautions are not enough to protect patients and healthcare workers against pathogens, nurses must use transmission-based precautions, which provide additional support for infection prevention. Nurses can advocate for themselves, patients, and families to ensure that agencies follow proper policies and procedures to promote the highest patient outcomes. All healthcare employees must receive proper training and education regarding how to reduce their risk for exposure. This may include exposure to certain substances as well as sharps safety. Emphasis must be placed on following proper hand hygiene, and proper PPE protocols can greatly reduce risk of exposure. Special considerations should be made regarding the use of antibiotics to not increase the incidence of MDROs. Patient education on this topic helps to prevent infection with these resistant bacterial agents.

Key Terms

active immunity immunity that results from the production of antibodies to help protect the body from a pathogen that has entered the body

airborne precaution a practice indicated for patients known or suspected to be infected with pathogens that are transmitted through droplet nuclei

airborne transmission the spread of pathogens that are carried by dust or the nuclei of an evaporated droplet and remain suspended in the air

antibody (also, immunoglobulin) a protein created in the body in response to an antigen in order to fight the identified substance or toxin

antigen anything the immune system recognizes as a foreign object or substance and subsequently initiates formation of antibodies

asepsis the state of being free from disease-causing contaminants

chain of infection the six stages of infection that must be present for the transmission of a pathogen from one place or person to another

contact precaution a practice implemented for patients who have known or suspected infections that can be transmitted through direct skin-to-skin contact or indirect contact with environmental surfaces or equipment

convalescent period the time when recovery and healing begin

direct transmission the spread of a pathogen that is transmitted directly from an infected person

disinfection the process of removing microorganisms and disease-causing pathogens from inanimate objects

droplet precaution a practice implemented when patients are known or suspected to be infected with pathogens transmitted by respiratory droplets from coughing, sneezing, and talking

droplet transmission the spread of a pathogen that travels through a spray of water droplets that are released when an infected person coughs, sneezes, or talks

fever a rise in core body temperature

healthcare-associated infection (HAI) an infection that is acquired while receiving medical treatment in a healthcare facility

illness period the third stage of infection, which starts when a person experiences the specific signs and symptoms of a disease

incubation period the initial stage of infection when a pathogen successfully enters into a new host

indirect transmission the spread of a pathogen to a new host through an intermediary, such as the air, food, water, animals, or objects

infection control the discipline of stopping or preventing the spread of infectious agents

inflammatory response one of the first responses when a pathogen breaches the nonspecific innate immune system; it aids in the recruitment of cellular defenses to remove pathogens

medical asepsis techniques and procedures used to decrease the potential for the spread of microorganisms and infection

medical isolation gown a garment worn in the healthcare setting as a broad barrier against blood or bodily fluids

microorganism a single-celled organism that is microscopic in size and too small to be seen by the naked eye

multidrug-resistant organisms a bacterium that has become resistant to certain antibiotics

N95 respirator mask a tight-fitting mask that protects the wearer from very small particles that float in the air

normal flora microorganisms that can live on another living organism or inanimate object without causing diseases or complications

passive immunity the result of antibodies being passed from one person to another

pathogen any type of microorganism that causes disease to its host

personal protective equipment (PPE) a means of barrier protection for eyes, nose, mouth, and skin from exposure to blood and other potentially infectious bodily fluids and materials

portal of entry the site at which a pathogen enters the susceptible host

portal of exit the path by which the pathogen leaves the reservoir

prodromal period the second stage of infection, which begins at the initial appearance of mild or vague symptoms

reservoir the habitat or source of the pathogen that provides a place for survival and growth

sanitization the removal of visible soil from objects and materials

sepsis the body's extreme response to a widespread infection

sharps needles and other objects, such as lancets, razor blades, scissors, clamps, pins, staples, and glass items

standard precaution the first tier of precautions to protect healthcare staff and patients

sterile gloves a glove that is free from microorganisms and individually packaged as a pair to remain free of pathogens

sterile technique practices and procedures that inhibit microorganisms in a specific environment and prevent contamination

sterilization a procedure that eliminates all microorganisms in or on an object
surgical asepsis the absence of all microorganisms within any type of invasive procedure; requires the use of sterile technique
surgical gown a garment worn by healthcare personnel during a surgical procedure to protect both the patient and the personnel from transmission of pathogens
surgical mask a mask that prevents transmission of large particle droplet matter generated through coughing or splash-generating procedures
susceptible host the organism that is susceptible to or at risk for infection
transmission the method that a pathogen uses to spread from one host to another
transmission-based precaution a practice implemented in situations where standard precautions are not adequate to prevent infection transmission
vector transmission the spread of a pathogen that occurs when blood-feeding arthropods infect animals or humans
zoonosis an infectious disease that can naturally transmit from animal to human

Assessments

Review Questions

1. A patient being seen in urgent care is complaining of vague and generalized symptoms. What stage of the infection process is the patient in?
   a. incubation
   b. prodromal
   c. illness
   d. convalescent

2. A patient has been experiencing a cough and sore throat for several days. While at work, the patient sneezed several times while sitting close to a coworker. Two days later, the coworker developed the same symptoms. What mode of microbial transmission took place here?
   a. direct contact
   b. indirect contact
   c. droplet transmission
   d. vector transfer

3. After receiving the varicella vaccination, a patient states that they now have immunity against this virus. What type of immunity does the patient have?
   a. natural active immunity
   b. natural passive immunity
   c. artificial passive immunity
   d. artificial active immunity

4. A patient presents to urgent care after cutting themselves with a knife while eating an apple. The patient became concerned after noticing redness and warmth at the injury site. What education can the nurse provide related to these findings?
   a. An artificial passive vaccine should be administered to prevent further damage.
   b. The patient should expect the cut to turn black before healing begins.
   c. Redness and warmth are expected assessment findings.
   d. The patient may be allergic to apples and will need additional allergy testing.

5. What does the CDC recommend as the length of time someone take to perform hand hygiene using an alcohol-based hand sanitizer?
   a. ten to fifteen seconds
   b. twenty to thirty seconds
   c. forty to fifty seconds

d. fifty to sixty seconds

6. A nurse is preparing to enter the room of a patient on droplet precautions. What is the correct order for application of PPE?
   a. handwashing, gown, mask, eye protection, gloves
   b. handwashing, mask, gloves, gown, eye protection
   c. mask, handwashing, gown, eye protection, gloves
   d. mask, handwashing, gloves, gown, eye protection

7. A nurse is setting up a sterile field to insert an indwelling catheter into an older patient who has dementia. During the setup, the patient accidentally drops their leg inside the sterile field. What is the appropriate nursing action?
   a. Call for another nurse to hold the patient's leg and continue setup.
   b. Remove the portion of the field that was contaminated and continue setup.
   c. Continue setup because no objects were touched by the patient.
   d. Discard the supplies and prepare a new sterile field with another nurse assisting in holding the patient.

8. A nurse is preparing a sterile field to complete a sterile wound dressing change. What action would indicate a break in the sterile field?
   a. remaining 1 ft (30 cm) away from nonsterile areas
   b. placing additional sterile items in the sterile field
   c. not utilizing the 1 in (2.5 cm) border of the sterile field
   d. reaching 1 ft (30 cm) over the sterile field

9. The nurse is admitting a patient who has tuberculosis to the hospital. What tier of precautions must the nurse institute when caring for this patient?
   a. droplet contact
   b. airborne contact
   c. direct contact
   d. indirect contact

10. What is the first step in protocol for a nurse who has been stuck by a needle?
    a. Report to the emergency department.
    b. Place the needle in a biohazard bag.
    c. Call an infectious disease doctor.
    d. Wash the area thoroughly with soap and water.

11. The nurse is speaking with a patient about their new diagnosis of *Clostridioides difficile*, highlighting that his infection is no longer impacted by antibiotics. How is this type of infection categorized?
    a. hospital-specific organism
    b. multifactor-resistant infection
    c. hospital-created infection
    d. multidrug-resistant organism

Check Your Understanding Questions

1. Discuss the chain of infection and how the chain can be broken.
2. How will the treatment of a bacterial infection differ from the treatment of a viral infection?
3. Why is it important for a healthcare worker to know what type of precautions a patient is on before donning PPE?
4. When opening a sterile package, which part of the package is considered nonsterile?
5. What precautions should be implemented for a patient on contact precautions?

6. What steps can a nurse take to prevent needlesticks?

Reflection Questions

1. A patient in an outpatient clinic states that they have not been feeling well since yesterday and their temperature has been 100.2°F (37.9°C) since earlier that morning. The patient asks the nurse if they should take Tylenol for the fever. What education should the nurse provide to the patient about infection and fever?
2. Two patients present to the outpatient clinic with different complaints. Patient A has a 100.2°F (37.9°C) temperature since early this morning and reports that he got the influenza vaccine yesterday. Patient B has a 98.5°F (36.9°C) degree temperature and complains that his right arm is swollen and red near an elevated area "that looks like a little hill." Explain the differences in the patient's symptoms based on the principles of immunity and the inflammatory response.
3. Discuss the role nurses play in the prevention of healthcare-associated infections.
4. A nurse observes an unlicensed healthcare worker preparing to enter a contact precaution room. They observe the worker donning gloves first, then the isolation gown. What education can the nurse provide the worker about donning PPE?
5. Discuss the principles of sterile technique and how a nurse can maintain sterility.
6. Why are multidrug-resistant organisms a threat to patient safety?

What Should the Nurse Do?

1. The nurse is assigned a patient who is being treated for RSV and is in droplet precautions. Thinking about the infection chain, the nurse wants to impede the spread of RSV by interrupting this chain with their nurse care. What are two things the nurse can do to interrupt this chain? What step in the chain are they interrupting with each action?
2. The nurse is caring for a patient who is infected with methicillin-resistant *Staphylococcus aureus* (MRSA). The patient is angry that the nurse is always wearing gloves and a gown and asks, "Do you think I'm dirty?" How should the nurse respond?
3. The nurse is speaking with a group of students regarding cleaning protocols on the unit. One of the students asks, "What are examples of items in which we would use disinfectants?" How should the nurse respond?

A nursing student has been assigned to a 75-year-old female patient who has a diagnosis of *Clostridioides difficile*. The patient is incontinent and needs assistance with bathing and hygiene. The charge nurse has requested the nursing student to assist with providing care for the patient.

4. What infection prevention and control precautions should be incorporated into the patient's care to decrease the risk of spreading infection?
5. What education can the student nurse provide to the patient and family?
6. How can being on isolation precautions impact the patient's mental health?
7. A new graduate nurse is speaking with an experienced nurse regarding their concern about their known sensitivity to latex. The new graduate nurse is worried about using latex-containing products and fears they will not be able to complete their job duties. How should the experienced nurse respond?

Competency-Based Assessments

1. Map out the infection chain, labeling each step. Then, identify three ways that this chain can be broken.
2. Create a poster comparing and contrasting medical and surgical asepsis. Share with a peer.
3. Use the internet to find a demonstration of sterile technique for a medical procedure. If possible, replicate this demonstration. If resources are not available, vocalize each step as you simulate the experience.
4. Develop a ten-minute presentation discussing how the nurse can promote patient safety through infection control.
5. Review the competency checklists for this chapter and have a peer or instructor assess your performance of

the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 7

Hygiene

FIGURE 7.1 Patient hygiene is of paramount importance in all healthcare settings and has significant implications for both patient well-being and infection control. Maintaining proper hygiene practices for patients helps prevent the spread of infections, enhances patient comfort, and contributes to overall health. (credit: modification of "U.S. Navy Sailors perform medical care at Billings Clinic Hospital 211113-A-PE084-003" by Navy Medicine/Flickr, Public Domain)

CHAPTER OUTLINE

7.1 Hygiene Practices

7.2 Factors Influencing Personal Hygiene

7.3 Assisting with Hygiene and Health Promotion

INTRODUCTION You are a nurse assessing an 87-year-old patient in a care facility who has very limited mobility. Your patient welcomes you in while ambulating with a walker and slowly removes some items from a chair, signaling for you to sit. As you strike up a casual conversation to build rapport, you begin to observe their disheveled appearance. You notice their unkempt hair, soiled clothing, rough skin, and dirt under some of their fingernails. Your sense of smell detects body odor, indicating a lack of bathing and oral care. Evaluating patient hygiene is important to determine how well a patient can care for themselves or how well someone is caring for them. Good hygiene is necessary for health, comfort, personal well-being, and safety.

7.1 Hygiene Practices

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the importance of good hygiene practices
- Describe hygiene-related diseases
- Recognize the impact good hygiene has on mental health

The term **hygiene** is defined as the measures or practices conducive to preserving health and preventing disease

through cleanliness. The self-care measures one would perform to preserve their own health are called **personal hygiene**. Examples of personal hygiene include handwashing, bathing, brushing and flossing teeth, as well as washing and combing hair. These measures may seem like basic tasks; however, they are essential procedures that aid in preserving one's health. Hygiene practices promote **medical asepsis**, also known as the clean technique, inhibiting the growth and spread of disease-producing microorganisms. Hygiene practices may vary among individuals and cultures. Allowing patients to perform self-care tasks as independently as they can for the purposes of preserving the patients' quality of life, self-worth, and autonomy is crucial to maintaining the individual's self-esteem and independence (both present and future). Performing self-care tasks also allows the nurse to determine the patient's ability to perform activities of daily living (ADLs) during recovery while the patient is working toward discharge. Patients may often need assistance, so the nurse's responsibility is to oversee the patient's privacy as well as their ability to adequately perform the various hygiene tasks. For instance, some circumstances may be presented when the patient is fully dependent on the nurse to aid in necessary bathing, elimination, bed making, oral care, or any other tasks. Nurses aiding patients with hygiene have an obligation to respect individual patient preferences while providing the care that the patient should not or is not able to provide for themselves. In addition, nurses should take into consideration the patient's physical and emotional well-being.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Patient-Centered Care

Definition: Recognize the patient or designee as the source of control and full partner in providing compassionate and coordinated care based on respect for patient's preferences, values, and needs.

The nurse will:

- Examine common barriers to active involvement of patients in their own healthcare process.
- Describe strategies to empower patients or families in all aspects of the healthcare process.
- Respect patient preferences for degree of active engagement in care process.
- Integrate understanding of multiple dimensions of patient-centered care: patient/family/community preferences and values, coordination and integration of care, physical comfort and emotional support, involvement of family and friends, and transition and continuity.

Benefits of Good Hygiene Practices

Good hygiene practices include not only personal hygiene but also those measures that may require a nurse's or an aid's full or partial assistance. Hygiene practices promote medical asepsis and prohibit the growth of pathogenic microorganisms, which leads to decreased chances and/or incidence of infection. Good hygiene can not only protect an individual from becoming ill but can also prevent individuals from spreading diseases to others. Good hygiene also promotes self-esteem and can boost a patient's mood, resulting in improved mental health.

Skin

The skin is the largest organ and the body's first line of defense. This organ provides a barrier to protect the body from invasion of bacteria or other potential environmental hazards. The skin houses various functional body structures, such as the capillaries, vessels, and glands. For example, the dermis layer of the skin contains sebaceous glands. These glands release **sebum**, an oily secretion that hydrates and protects the skin. It is important to note this glandular function, as inadequate hygiene may lead to excess sebum and skin breakouts. Proper hygiene practices can help promote and maintain skin integrity. Regular exfoliation and cleansing can promote smoother, softer, and more even-toned skin, slower aging, and boost circulation. In turn, these measures allow the skin to properly perform the functions of protection, sensation, heat regulation, excretion, secretion, and absorption. Each function plays a pivotal role in maintaining homeostasis and preserving the individual's health. For example, when the skin integrity is intact, the skin is able to prohibit the entry of pathogens, prevent water loss, and reduce the absorption of harmful chemicals or substances (World Health Organization, 2020). In addition, the regular practice of skin hygiene allows for early detection and intervention of abnormal skin growths that may appear.

The **skin breakdown** refers to damage or injury to the skin and underlying tissue due to prolonged pressure, friction, shear, or moisture. Examples of skin breakdown include burns, scrapes, cuts, blisters, and pressure injuries. Factors

associated with skin breakdown include immobility, certain medications, incontinence, altered mental status, loss of sensation, or inadequate nutrition. Therefore, the crucial maintenance of proper skin hygiene in the healthcare setting must be ensured. Any skin breakdown that develops after a patient is admitted to a facility becomes the healthcare facility's responsibility, including the financial burden for the treatment and recovery of the skin injury. Preventing skin breakdown through good skin hygiene can result in optimal healing of a patient's skin and prevent an increase in healthcare costs, length of stay, and patient discomfort.

Hair

The hair is also part of the integumentary system and is found all over the body, except the palms of the hands and soles of the feet. Hair is a large part of the integumentary system and has several functions. First, hair has a protective function. By trapping bacteria, debris, and harmful particles, the hair does not allow these offensive agents to enter the skin. Hair also blocks sunlight from the scalp, protecting against excess exposure to ultraviolet radiation. Hair provides warmth by trapping air close to the skin. Hair grows from the skin and when the skin produces sebum, it can build up on the hair shaft. An overabundance of sebum can build up if the hair or body is not regularly washed. A common skin condition is folliculitis, which happens when hair follicles become inflamed; it can occur when the hair follicles become infected due to the buildup of sebum (21.2 Factors Affecting Skin Integrity). When the scalp of the head is not regularly washed, dead skin, product residue, sweat, and dirt may also build, which results in an increased risk for infection, unpleasant odor, and greasy hair. In addition, prolonged periods of not washing the hair on the head can damage hair and impede its ability to grow. When the body is not regularly washed, the overproduction of sebum found on the skin can lead to oily skin or acne. Proper hair hygiene supports reducing those risks and aids in reducing bacterial and fungal growth. Bacteria and fungus can cause conditions such as ringworm, which is a common fungal infection of the skin, hair, or nails.

Nails

The nails are also part of the integumentary system. Proper nail hygiene prevents the spread of infection through bacteria hidden under the fingernails. Additional benefits of nail hygiene include preventing fungal infections under the nails, reduced risk of ingrown nails, and promoting proper nail growth. Therefore, proper cleaning under the fingernails and keeping the nails trimmed using clean tools are essential practices. Another benefit of properly trimmed nails is the minimized risk of lacerations that can result from a patient using unkept nails to scratch themselves or others.

Oral Cavity

Good oral hygiene aids in maintaining the mouth, gums, lips, and teeth. Regular teeth brushing removes plaque, bacteria, and food particles to prevent tooth decay. These measures also massage the gums, help break up tissue or bacteria, increase blood flow, and relieve discomfort caused by unpleasant odors and tastes. Proper oral hygiene promotes digestion and gum health, and it can affect one's overall health status. For instance, bacteria found in gum disease from poor oral practices can travel through the body, triggering infection and inflammation in heart valves. Good oral hygiene can also provide a patient with a sense of well-being and positive self-esteem, resulting in improved mental health. A condition expressed by foul-smelling breath, **halitosis**, can be considered embarrassing and impede someone's desire to speak or smile. Without adequate oral care, patients who are taking nothing by mouth (NPO) can suffer negative outcomes that include aspiration pneumonia. Those patients who are NPO or on ventilators need frequent oral care to prevent ventilator-associated pneumonia. Oral hygiene can stimulate an appetite by increasing salivary flow, which supports proper chewing to break down food. Proper oral hygiene also prevents diseases such as gingivitis or periodontitis, which will be discussed later in this chapter.

LIFE-STAGE CONTEXT

Life Span Considerations for Older Adults

As the body ages, there is a decrease in saliva production, which can lead to dry mouth, tooth decay, a sore throat, and difficulty swallowing. Saliva contributes to the overall oral health by washing bacteria and food particles from the mouth. Maintaining oral hygiene as a patient ages is especially important and may require more frequent brushing at home. For example, the caretaker or older adult may want to add oral care after meals in addition to morning and night cleanings. Good oral hygiene practices promote the preservation of the older adult's ability to eat

by promoting the production of saliva to stimulate the appetite. In addition, proper oral hygiene maintains oral health and dentition to be able to chew and digest food. Because the saliva contributes to overall oral health by washing food particles and bacteria from the mouth, proper oral hygiene promotes dental health and maintains dentition. The better oral health patients have throughout their life, the greater the probability that these individuals will have functioning teeth with aging. To promote good dental hygiene practices, it is important to educate and encourage patients in establishing dental care routines. These practices include proper denture hygiene, such as cleaning dentures with a denture brush daily followed by placing the dentures in a cleansing soak overnight.

Perineum

Perineal care includes the genital and rectal areas of the body. Because the perineal area is warm, dark, and moist, these areas become an optimal breeding ground for bacteria. Good perineal hygiene prevents infections such as urinary tract infections, removes discharges, eliminates bad odor, promotes comfort, alleviates itching, and reduces the risk of chafing and skin rashes. Perineal hygiene is of particular importance during menstruation, after bowel movements, postpartum, and when hemorrhoids are present.

LINK TO LEARNING

The Centers for Disease Control and Prevention (CDC) has a quick reference for hygiene and personal hygiene facts, tips, and other resources (https://openstax.org/r/77HygieResource) and is a great source to share with patients to aid with patient education and self-care.

UNFOLDING CASE STUDY

Unfolding Case Study #2: Part 1

The nurse is providing care to a 71-year-old male patient in a nursing home setting. The patient is a new resident, having been in the facility for only one month. The patient's daughter, Alicia, is visiting with him and requests to speak to the charge nurse about some concerns she has about her father's care.

Past Medical History	Patient's medical history includes COPD, GERD, hypertension, hyperlipidemia, and myocardial infarction with stents placed fifteen years ago. **Family history:** Patient has four adult children, but only one lives in town. When asked about his children, the patient states, "Only one of my kids, my Alicia, talks to me. The rest live too far away and never call or visit." **Social history**: Previous occupation as a farmer. Recently sold the farm to a developer when he moved into the nursing home. Patient states, "I was forced to sell my home and farm because it wasn't making money anymore." **Current medications:** • lisinopril (Zestril) 10 mg daily • atorvastatin (Lipitor) 20 mg daily • hydrochlorothiazide (HydroDIURIL) 50 mg daily
Nursing Notes	**0700:** Patient received morning medications and is resting comfortably in recliner. Daughter is at bedside requesting to speak to charge nurse about care concerns. When the charge nurse arrives, daughter states, "Every single time I come to see my dad, he's soiled. It seems like no one is ever checking to see if he needs to use the bathroom, so he ends up just going in his pants. I'm worried that he's going to get a UTI or have other serious issues if this continues. I will contact my lawyer if this doesn't get taken care of immediately."

1. Recognize cues: Based on the daughter's concerns, what follow-up assessments should the nurse

perform?

2. Analyze cues: Based on the assessments performed in question 1, what assessment findings would indicate the need for intervention by the nurse?

Hygiene-Related Diseases

Poor hygiene can include infrequent bathing or washing of hair, inadequate oral care, wearing soiled clothing, and untrimmed or dirty nails. Poor hygiene can result in infections as well as various hygiene-related diseases, such as tooth decay, scabies, pinworm infection, ringworm, trachoma, otitis externa (swimmer's ear), urinary tract infection, sepsis, gingivitis, and periodontitis.

Many diseases and conditions of the body systems can be prevented or controlled through regular hygiene practices. These practices include brushing teeth and routinely washing parts of the body and hair with soap and water. Implementing and encouraging regular body washing and oral care can prevent the spread of hygiene-related diseases outlined in Table 7.1.

Body System	Hygiene-Related Disease or Condition	Image
Integumentary	**Scabies** is a contagious skin infestation caused by a burrowing mite.	(credit: "ScabiesD03" by Unknown/Wikimedia Commons, Public Domain)
	A **pinworm** is an intestinal worm that usually spreads when an infected individual scratches the anal area and eggs get under the fingernails.	(credit: "Threadworm" by Erich Gasboy/English Wikipedia, Public Domain)

TABLE 7.1 Common Diseases Caused by Poor Hygiene

Body System	Hygiene-Related Disease or Condition	Image
	A **ringworm** is a highly contagious fungal infection of the skin or scalp.	(credit: Untitled by Centers for Disease Control and Prevention, Public Domain)
	An infestation with lice, easily spread in crowded areas or where people are in close contact is called **pediculosis**.	(credit: Untitled by James Gathany/Centers for Disease Control and Prevention, Public Domain)
Digestive	When the outer surface of a tooth decays as a result of bacteria, this is referred to as **tooth decay**.	(credit: "Oral Rehabilitation and Management for Secondary Sjogren's Syndrome in a Child" by Unknown/Hindawi, CC BY 4.0)
	The inflammation of the gums, or gingivae, is called **gingivitis**.	(credit: modification of work "Gingivitis-before-and-after" by Wikimedia Commons, CC0)

TABLE 7.1 Common Diseases Caused by Poor Hygiene

Body System	Hygiene-Related Disease or Condition	Image
	Marked inflammation of the gums that also involves degeneration of the dental bone and tissues is called **periodontitis**.	(credit: modification of work "Periodontitis 01" by Francisco B. Teixeira, Miki T. Saito, Filipe C. Matheus, Rui D. Prediger, Elizabeth S. Yamada, Cristiane S. F. Maia, Rafael R. Lima1/Wikimedia Commons, CC BY 4.0)
Sensory	Swimmer's ear, **otitis externa**, is an infection of the outer ear canal that runs from the eardrum to the outside of the head and is often caused by water remaining in the ear after swimming.	(credit: "Otitis externa" by Klaus D. Peter/ Wikimedia Commons, CC BY 3.0)

TABLE 7.1 Common Diseases Caused by Poor Hygiene

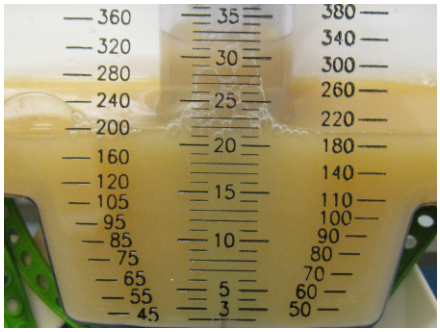
Body System	Hygiene-Related Disease or Condition	Image
	Bacterial infection of the eyes is called **trachoma**.	(credit: modification of work by Tim Kubacki/Flickr, CC BY 2.0)
Urinary	A **urinary tract infection** (UTI) is an infection of any part of the urinary system: urethra, bladder, or kidneys.	 (credit: "Pus in urine in a severe urinary tract infection" by John Campbell/Flickr, Public Domain)

TABLE 7.1 Common Diseases Caused by Poor Hygiene

Many hygiene-related diseases can continue to progress if left untreated. For example, gingivitis can be treated and resolved. However, untreated gingivitis can lead to periodontitis, which is a severe stage of gum disease. As periodontitis worsens, holes form around the teeth, forming pockets. The infection and pockets can deepen as the jaw deteriorates until teeth become loose and fall out. This type of infectious process can even lead to an earache. However, with proper oral hygiene and dental care, both gingivitis and periodontitis can be prevented or resolved.

Hygiene's Impact on Mental Health

Poor hygiene can be a sign of self-neglect and is often accompanied by depression or other mental disorders. Those with obsessive-compulsive disorder may overindulge in hygiene practices, which can take up much of their time as well as lead to skin breakdown or pain, depending on their compulsions. As previously discussed, poor oral hygiene can lead to tooth decay or bad breath. This can have a negative impact on self-esteem as one may be embarrassed to smile or socialize with others.

Good hygiene and self-care practices can improve mood, decrease stress levels, provide a sense of well-being, and prevent or limit anxiety. These measures can also boost an individual's self-esteem and confidence. Good hygiene also supports a positive impact on relationships as hygiene impacts attraction and physical intimacy.

REAL RN STORIES

Assisting with Hygiene

Nurse: Stephanie, RN
Clinical setting: Acute care hospital
Years of experience: 5

Facility location: Texas

One day, I walked in to perform a shift assessment on a patient. I noticed that the patient appeared gloomy or worried. I asked her if she would like to discuss what seemed to be worrying her. She stated that her daughter was coming to visit her for the first time since admission, and that her daughter had never seen her ill before, and that she was worried about her appearance. I asked what time her daughter was arriving and if she would like to have a bath before the daughter arrived. The patient appeared excited and stated that a bath would be great. The patient suggested a time for bathing, as well as what preferences she had in assistance with the bath. I returned with towels, soap, shampoo, lotion, a comb, a toothbrush, and toothpaste. The patient required minor assistance, so I helped her with the bath, washing the areas she couldn't reach, and styling her hair. Upon completion, the patient was smiling and even making jokes. She told me she felt better after the bath and was now looking forward to, instead of dreading, the visit from her daughter.

7.2 Factors Influencing Personal Hygiene

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe population differences contributing to personal hygiene practices
- Identify physical factors impacting personal hygiene practices
- Identify psychological factors impacting personal hygiene practices

Hygiene measures and practices can promote health and prevent disease. These measures and practices may differ among various groups and people. It is important to remain culturally sensitive when encountering preferences that may differ from your own. The term **cultural sensitivity** is defined as recognizing and acknowledging that cultural differences exist among people and showing respect and appreciation of others' beliefs, values, practices, and perspectives. Respecting patient differences and preferences in hygiene practices while remaining unbiased is essential to the nursing practice. Nurses must also remember to provide care and education to patients in a nonjudgmental manner.

Population Differences in Hygiene Practices

Cultural practices or behaviors, socioeconomic status, developmental level, and personal preferences are factors that influence an individual's hygiene practices. These factors may differ greatly from one individual to the next. Understanding these differences and factors that impact how an individual practices personal hygiene is important as a nurse. Nurses may need to modify care and education to meet the needs of the individual patient.

Cultural Preferences

Cultural factors can strongly influence hygiene practices and patient preferences. Identifying those variations and their impact on a patient's personal hygiene is crucial. Nurses can identify cultural variations by asking the patient about their normal hygiene routines. The nurse should also explain that the reason for asking is not to be offensive, but rather to understand their practices, reminding the patient about the impact hygiene can have on an individual's physical and mental health. The nurse may need to ask specific questions such as, "How do you clean and take care of your body?" or "Tell me about your oral hygiene routines."

Cultural preferences may impact hygiene practices in terms of frequency and the type of products used. For example, people in some cultures place a high emphasis on daily bathing; otherwise they feel unclean. There are other cultures in which people may bathe only once a week. In addition, there are some cultures that also consider the use of products to mask body odor essential, while other cultures may deem those products as unsafe and view body odor as pleasant rather than unpleasant. Learned behaviors, such as touch, are also culturally significant. Some cultures may find touch offensive, which is important for the nurse to remember. Asking for permission before touching a patient when helping with hygiene practices is crucial to remember as well. The nurse should keep in mind that some cultures practice communal versus private bathing. Nurses are not to stereotype hygiene preferences based upon one's culture; rather, nursing personnel should ask the patient about their preferences and beliefs to provide care that aligns with the patient as an individual.

CULTURAL CONTEXT

Cultural Considerations and Personal Hygiene

Personal hygiene is especially important to East Indian Hindu culture. To many individuals from this culture, a daily bath is a religious duty. Some Hindus believe that bathing after a meal will result in an injury. Some Hindus also believe water that is too hot will injure their eyes. When preparing a bath, these persons may also believe that hot water can be added to cold water but not vice versa. Once the individual has completed the bath, they must carefully and thoroughly dry the body. Personal hygiene practices can differ among individuals and communities, even within the same religious group. Additionally, modern lifestyles and urbanization may influence personal hygiene habits that differ from the traditional cultural habits. For instance, cultural diffusion is the spreading out and merging of pieces from various cultures. This type of cultural shift is a common practice in today's ever-evolving society. Cultural appropriation, which is the exploitation of another culture's religion and/or cultural traditions, can be found offensive by some and should be avoided by the nurse. Understanding and respecting these cultural and religious practices is essential for providing culturally sensitive care and fostering positive interactions with people from the East Indian Hindu culture.

Socioeconomic Status

A person's socioeconomic status and financial resources often influence the type or extent to which hygiene is practiced. An individual's socioeconomic status and finances often impact the resources available. Financial limitations may impact the ability to obtain clean clothing or toiletries but could also influence water usage or access. Sometimes a person may have to make a choice between buying food to feed their family and purchasing personal hygiene products. Another example of financial limitations is homelessness. An individual may only be able to access a public bathroom, which limits choices to the type of soap and water that is available. Oftentimes, a public bathroom has only a sink with no shower or privacy. Therefore, the person experiencing homelessness is limited to how much of their body can be cleaned at one time.

Developmental Level

Hygiene practices are behaviors that most people learn as children from family members or others surrounding them. Those behaviors may include frequency and/or time of day in addition to feelings of modesty and nudity. Infants are dependent upon others for hygiene needs, but as children grow into adolescents, they may become more concerned with personal appearance while adopting individual practices. For example, adolescents may become aware of their body odor and develop preferences for using deodorants or body sprays. The teen may even acknowledge the need to bathe more frequently and make an autonomous choice to practice such a regimen. Adolescents also tend to prefer privacy, performing independent hygiene rather than in the presence of others. Therefore, hygiene education may be impacted when a parent is present. The nurse may need to ask the parent to step out of the room in order to offer privacy for the young adult, properly identify preferences, and provide any needed education.

A person's developmental level can negatively impact hygiene practices if the ability to understand proper hygiene practices is impaired or limited. A child who wants to be independent may want to perform their own hygiene but may not be able to effectively apply the proper measures to achieve this goal. Older adults may experience mobility limitations that impact the frequency of bathing or ability to reach all areas of the body.

Personal Preference

Personal preference is a significant factor in a person's hygiene practices. Considering a person's preferences when scheduling or aiding with hygiene is important. Some preferences may include bathing in a bathtub versus using a shower, morning bathing versus evening bathing, and the types of soaps, shampoos, conditioners, toothbrushes, toothpastes, cloths, or loofahs used to facilitate the individual's body cleaning. A person's sexuality and self-concept may also impact their hygiene practices. For example, sexually active women may use a variety of feminine hygiene products after intercourse to promote cleanliness.

Frequency of hygiene practices are influenced by a patient's personal preferences, possibly stemming from cultural influences, social practices, or hygiene education. Some people prefer to bathe daily, wash their hair every other day, and perform oral care twice a day. Still others may prefer a different frequency schedule. Hair and nail care

frequency preferences may depend on nail length or appearance, which a person may use to gauge when they feel that care is warranted. For example, a person who prefers their nails a certain length may use nail length as their cue to perform nail hygiene. Hair preferences may also vary among individuals. Some people prefer the hair a certain length and will use hair length as a cue to get a haircut. Some individuals may prefer their hair to be free of oils and will use the level of oil in the hair as a cue to wash their hair. Also, some people prefer to have a clean-shaven face and will shave or trim the facial hair to keep it at the desired length.

The timing of hygiene practices is also influenced by a patient's personal preferences. Some patients prefer bathing at the beginning of the day to perk themselves up while others prefer the end of the day, finding bathing to be relaxing instead. Oral care timing preferences may include upon waking, prior to sleeping, or even after meals. For example, a person with braces may perform oral care after every meal to decrease food build up and odors. In the hospital setting, the timing may also be impacted by any tests or procedures scheduled for the patient. This timing could be due to the required prewashing with or without specialized products prior to certain diagnostics.

PATIENT CONVERSATIONS

What If You Think Your Patient Is Refusing a Bath?

Scenario: A medical-surgical nurse was completing rounds to assess patients' hygiene needs. The nurse notices their 62-year-old male patient had an odor, food stains on his face and gown, and soiled hair.

Nurse: Hi, Mr. Thomas. I hope you enjoyed your breakfast. Would you like to schedule a bath this morning?

Patient: Well, no. I only like to bathe at night. I like to be clean before I get into bed. My mom always told me when you go to bed without a shower, you're taking your whole day to your sheets.

Nurse: Okay, Mr. Thomas. I understand. I will make a note of your request, so that the night shift staff can assist you with your bath.

Scenario follow-up: The nurse pulls up the patient's chart in the patient room to document the patient's request and noticed that for the last three days, the patient had refused a daytime bath. There was no documentation of the patient's request for a nighttime bath, so the nurse wondered if the patient was refusing a bath overall.

Nurse: Mr. Thomas, have you told any of the other nurses that you prefer a nighttime bath?

Patient: Well, the first day I just told them no, but I did tell them on the second day I was here that I like nighttime baths. The night nurse never asked me about it though. I just assumed they were too busy.

Nurse: I am sorry about that. I just put in your request for a nighttime bath in the computer and will also make a note on the bath schedule at the charge nurse's desk. We can always do a bath this morning to get you caught up if you'd like.

Patient: No, dear. I can wait until tonight. I wouldn't mind just washing my face for now though.

Nurse: We can absolutely do that. Would you like a new gown in the meantime as well?

Patient: Sure. I would like that in case anyone comes to see me today.

Nurse: Okay, great. Is there anything else you would like to do this morning for hygiene?

Patient: No. I already brushed my teeth this morning.

Nurse: Okay. I will get your bath set up for you tonight. Is there anything you need before I leave the room?

Patient: No, I think I am good.

Nurse: Okay, well I will send in Suzie (unlicensed assistive personnel, UAP) to come help you with washing your face and getting you a new gown. Let me put your call light within reach, and you can always call us if you need us while we aren't in here.

Patient: Thanks a million.

Scenario follow-up: The dayshift nurse made a note on the bath schedule at the nurse's station and in the patient's chart. The UAP helped the patient get set up to wash his face and provided the patient with a new gown. At shift change, the nurse also informed the night shift nurse of the patient request. The patient received his bath that night and his linens were also changed. The charge nurse was also aware of the situation and provided education to all nurses to ensure they are marking patient preferences in the chart and on the bathing schedule as well as communicating any special requests to the appropriate shift nurses to ensure patient requests are being met.

Physical Factors Affecting Personal Hygiene

A person's physical condition will greatly impact personal hygiene. Mobility status and health state are important for a nurse to identify when caring for a patient and planning the individual's hygiene care.

Mobility Impairment

People with mobility impairment have limited hygiene measures and options. For instance, a paralyzed patient may require a bed bath performed by another person. Identifying the best practices for this patient and a hygiene schedule to protect their skin, increase comfort, and control odor is important. Providing a bath every day ensures a comprehensive skin assessment can be conducted, and taking extra steps to reposition more frequently will promote circulation as well as improve skin integrity.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Providing a Bed Bath

See the competency checklist for Providing a Bed Bath. You can find the checklists on the Student resources tab of your book page on openstax.org.

Health Status

The status of a person's health plays an important role in any plan of care. Injury, surgery, or disease can diminish an individual's capability or the desire to perform hygiene. With hygiene, a patient in the late stages of an illness may lack the energy or dexterity to perform their own personal hygiene. Some diseases may incapacitate or exhaust a patient, thus warranting the need for the caregiver to perform all aspects of this practice. For example, a person with serious pulmonary conditions may not be able to tolerate activities and may require a great deal of assistance.

Psychological Factors Affecting Personal Hygiene

Psychological factors that may affect personal hygiene include cognitive diseases as well as an individual's mental health status. The psychological factors will impact a person's ability to perform hygiene as well as the patient's motivation for or memory of these practices. It is imperative the nurse asses for any psychological factors that might inhibit a person's personal hygiene habits.

Cognitive Diseases

Some cognitive diseases or disorders that may affect personal hygiene include Alzheimer disease, attention deficit disorder, autism, intellectual disabilities, substance use disorder (SUD), and multiple sclerosis. Careful consideration by the nurse is necessary when planning hygiene for persons with any type of cognitive diseases or disorders due to the impact on a person's memory, focus, visual perception, abstract reasoning, and ability to learn or perform hygiene practices. For example, a person with a developmental disorder may struggle to learn the importance of self-care as well as how to perform the task. Patients with Alzheimer disease may lose the ability to remember to perform hygiene, struggle with emotions, and become agitated.

CLINICAL JUDGMENT MEASUREMENT MODEL

Recognize and Analyze Cues

Before recognizing cues, nurses must make sure enough information about a patient's situation has been gathered and assessed before interpreting the information and developing a plan of care. For example, an

individual with Alzheimer disease may struggle to perform hygienic activities. This person may also struggle to regulate emotions, becoming upset or embarrassed about being undressed in front of someone else. The patient may feel rushed or confused when being coached in performing various hygiene measures. The nurse must observe the patient and recognize the individual's Alzheimer disease stage of progression. In addition, the nurse must analyze the person's cues and assess the patient's ability to perform hygiene. A person's readiness to receive assistance in order to develop the patient's individual plan of care must also be considered.

Mental Illness: Depression

Hygiene can be greatly impacted by depression. People with depression may struggle with self-esteem and the motivation to perform hygiene measures. Depression may cause fatigue and cognitive effects such as negative thought patterns, memory problems, and brain fog. Individuals with depression may also struggle with executive dysfunction that impacts their ability to maintain hygiene and carry out the practices.

Body Image

Body image can also impact hygiene. People with depression often have a negative body image or do not care about their image. Those individuals with a negative body image may possess this image due to body shape, body size, or feelings of being ugly. A negative self-image can lead to stress regarding the undressing involved in the process of bathing. Often, patients experiencing this situation will avoid normal hygiene practices. The person with a negative body image may notice an improvement in self-esteem after performing hygiene or may lack the desire to perform hygiene. Those people with a positive body image may have the drive to establish and commit to a good hygiene routine in order to maintain the image of themselves in their mind.

7.3 Assisting with Hygiene and Health Promotion

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the steps for assisting with patient hygiene
- Analyze differences related to hygiene in the older adult
- Recognize how nurses can use education to promote healthy hygiene habits

The nurse must assess the patient's preferences, physical limitations, and cognitive status in order to analyze, develop, and promote a hygiene and health plan of care. Patients who are completely independent, require some assistance, or are fully dependent on the nurse or nurse's assistant to complete hygiene practices are all factors needing consideration. A nurse's priority when scheduling hygiene is to ensure the patient's safety. This section will focus on the steps for assisting patients with hygiene, the differences related to hygiene in older adults, and how nurses can promote healthy hygiene habits through education.

Steps for Assisting with Patient Hygiene

When assisting the patient with hygiene, the nurse must integrate the individual's preferences into the plan of care. Determining the patient's normal practices through inquiry are variables that influence hygienic practices. Those variables may include the person's health status, physical limitations, mental health state, cultural beliefs, and personal preferences. The nurse must also assess the appropriateness of these practices to conclude whether the patient has the attitude, skills, resources, and knowledge to carry out the measures independently or if assistance is required for this purpose. The nurse performs a physical assessment to determine the adequacy of the patient's hygiene practices. For the recognized practices to be deemed inadequate, a distinct health threat must exist. For example, upon examining the oral cavity, if gingivitis or periodontitis is visible, the patient may be at a higher risk for conditions such as heart disease, stroke, arthritis, and diabetes if left untreated.

For patients with intravenous (IV) access, the bag of IV fluids and IV tubing may be threaded through the sleeve of the gown to keep the system intact. There are covers available to keep the site dry during bathing. Dressing changes for the IV must follow facility protocols. Finally, the nurse must try to preserve the patient's privacy throughout the bathing process. To accomplish such privacy, a nurse should reveal only the areas about to be cleaned and keep the rest of the body covered, ensuring the door and/or curtains remain closed. The nurse needs to encourage the individual to perform all tasks as independently as appropriate. Using the bath or various hygienic procedures is an excellent opportunity for the nurse to assess the person's skin, cognition, and mobility status. These simple tasks

can reveal subtle changes in the patients' status and allow for early intervention.

In addition, whether the individual is conscious or not, the nurse or UAP must introduce themselves and always inform the patient of what is about to happen and why. This will hopefully prevent any surprises, obtain consent, and complement the nurse's professional demeanor. Research suggests that unconscious patients may hear what others are saying. Nurses who continue to introduce themselves and explain procedures before proceeding will decrease the stress on the individual through their journey to consciousness in a strange and foreign environment.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Patient-Centered Care

Definition: Recognize the patient or designee as the source of control and full partner in providing compassionate and coordinated care based on respect for patient's preferences, values, and needs.

The nurse will:

- Integrate understanding of multiple dimensions of patient-centered care: information, communication, and education; involvement of family and friends; patient/family/community preferences and values; coordination and integration of care; physical comfort and emotional support; and transition and continuity.
- Assess own level of communication skill in encounters with other members of the healthcare team as well as patients and families.
- Communicate patient values, preferences, and expressed needs to other members of the healthcare team.
- Communicate care needed and provided at each transition in care.
- Value continuous improvement of own conflict resolution and communication skills.
- Describe strategies to empower patients or families in all aspects of the healthcare process.
- Respect patient preferences for degree of active engagement in care process.

Delegation Considerations

The execution of hygiene practices may be delegated to a nurse's assistant, UAP, or a licensed vocational nurse. The term delegation in nursing is shifting the responsibility of tasks to another person while remaining accountable for the outcome. For example, the nurse may delegate a stable patient's bath to a UAP if and only if the bath is meant for cleanliness and not for assessment of skin or patient condition. Safe and proper delegation allows the registered nurse to attend to more complex patient care needs, such as medication administration or head-to-toe assessments, helps control cost for the organization and advances the skills of nursing assistive personnel. The patient's needs and health status plus the qualifications of the person the task is being delegated to must all be carefully evaluated. The nurse must have the proper qualifications prior to delegating: skills, experience, competency, and education. The person the nurse is delegating the tasks to must also have adequate education, skills, training, experience, and evidence of competency. Table 7.2 summarizes the National Council of State Boards of Nursing (2016) Five Rights of Delegation.

Right	Definition	Example
Right task	The activity coincides with the person's job description or is part of the written policies and procedures of the practice setting.	The nurse can ask a UAP to brush a patient's teeth but not to give medication.
Right circumstance	Appropriate patient setting, available resources, and other relevant factors are considered.	The nurse may ask the UAP to provide a bed bath for a stable patient. The nurse should ask for the UAP to not provide a bed bath when the patient is in severe physical distress, as the nurse should perform the patient's hygiene themselves.
Right person	Delegating the right task to the right person to be executed on the right person	The nurse may ask a unit secretary to call for supplies needed for the bath, such as special surgical wipes, but not ask the unit secretary to bathe the patient.
Right directions and communication	Clear, concise description of the task, including its objective, limits, and expectations	The nurse asking to be notified if the blood pressure is "abnormal" following the patient's bath is not appropriate. The nurse should ask the UAP to notify them if patients' blood pressure is above 130/80 or below 100/60 after the bath, in order to give clear expectations.
Right supervision and evaluation	Apt monitoring, evaluation, intervention, when necessary, and feedback	The nurse may ask the UAP to chart a patient's response to hygiene care if the patient is alert, awake, and oriented because the outcome is expected. The nurse may not ask the UAP to evaluate a patient's response to hygiene care if the patient is confused and unstable because the outcome is unexpected, and this type of evaluation is out of their scope of practice.

TABLE 7.2 The Five Rights of Delegation

UNFOLDING CASE STUDY

Unfolding Case Study #2: Part 2

Refer back to the Unfolding Case Study #2: Part 1 to review the patient data.

Nursing Notes	**0900:** Skin assessment performed. Redness in sacral and perineal areas noted but all skin intact. Patient was soiled at time of assessment so perineal care was performed and new briefs applied. Barrier cream applied on sacrum and buttocks. Patient resting comfortably in bed at this time. Daughter assured that charge nurse will speak to staff regarding importance of maintaining patient's hygiene care.

3. Prioritize hypotheses: What factors could be contributing to the patient's condition?
4. Generate solutions: The charge nurse holds a staff meeting for all nurses on the unit to discuss the importance of maintaining patient hygiene. When discussing the role of nursing assistants in maintaining patient hygiene, what is an appropriate task?
   a. Asking the nursing assistant to provide perineal care for an unstable patient.
   b. Allowing the nursing assistant to delegate hygiene care to the unit secretary when the unit is short staffed.
   c. Having the nursing assistant administer pain medication to the patient before performing hygiene care.
   d. Asking the nursing assistant to evaluate and document an alert and oriented patient's response to hygiene care.

Oral Care

Care of the oral cavity, **oral hygiene**, helps preserve a healthy state of the lips, gums, teeth, and mouth. Brushing the teeth removes plaque, food particles, and bacteria as well as massages the gums and alleviates any discomfort that may be caused from tastes or unpleasant odors. Patients should be encouraged to brush their own teeth when possible. Independent individuals should be offered supplies to also carry out personal hygiene needs as appropriate. If the patient is unable to do so independently, the nurse or appropriate delegate (i.e., the person who is delegated a responsibility by the nurse) will need to assist with or perform the oral care for this individual. Patients who are unable to perform their own oral care may require care every one to two hours, if and as necessary. Individuals who are either unable to breathe through the nose or are mouth breathers will need more frequent oral care. More frequent care will ensure that the integrity of the oral mucous is maintained. The nurse must ensure that available suction equipment is available to prevent aspiration, raise the head of the bed to 30–45 degrees, use suction to remove excess fluid/secretions, routinely moisten the mouth, and apply lip balm to prevent lips from cracking.

Teeth should be brushed twice a day and the mouth should be rinsed with water after meals. The toothbrush should be soft-bristled and reach all the teeth. Automatic toothbrushes may be adequate substitutes for patients with arthritis or other conditions that impair their ability to brush adequately. Because the toothbrush cannot reach the areas between the teeth, flossing is recommended once a day to remove food particles and plaque. Water picks, pressured water spray units, and cone-shaped brushes may be used when patients are unable to use floss or perform their own oral hygiene. Toothpastes and other powders aid in the brushing process. Mouthwashes may also be used to reduce bacteria, plaque, tartar, and gingivitis. Many mouthwashes also freshen breath and can protect tooth enamel.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Patient-Centered Care

Knowledge: Recognize the patient or designee as the source of control and full partner in providing compassionate

and coordinated care based on respect for patient's preferences, values, and needs.

Skill: The nurse will:

- Assemble supplies (e.g., toothbrush, basin, toothpaste, floss).
- Introduce themselves.
- Identify patient and explain procedure.
- Perform hand hygiene and don clean gloves;
- If the patient is independent, arrange the supplies in the bathroom, if the patient prefers, and ensure privacy.
- If the patient is unconscious, prepare the patient for the procedure by ensuring privacy, raising the bed to a comfortable position, and arranging supplies.
  - Position patient's head to the side (dependent side if possible).
  - Place a towel under the patient's face and an emesis basin under the chin.
  - Carefully separate the patient's jaws. Use a tongue depressor to hold the patient's mouth open with one hand.
  - With the other hand, brush teeth, gum, and cheeks gently with soft-bristled brush and toothpaste. Swab the tongue and roof of the mouth. Rinse several times.
  - Apply lubricant to lips.
- Clean and store supplies, and dispose of linens and trash appropriately.
- Remove gloves and perform hand hygiene.
- Reposition or assist patient to a comfortable position. Ensure the bed is in the lowest position.
- Document procedure and patient's response.

Denture Care

Artificial teeth not permanently implanted, called **dentures**, are the patient's personal property and must be handled with care. Dentures should soak in a labeled, enclosed cup to be stored when not being worn. Many patients do not wear dentures when sleeping, and dentures must be removed for surgeries or other diagnostic procedures. Many patients also prefer to wear dentures as soon as wakening or coming out of a procedure to avoid embarrassment due to feeling self-conscious without them. If the patient goes long periods of time without wearing the dentures, the gum line may change and affect the fit of the dentures. It is also recommended that dentures not be worn twenty-four hours a day, seven days a week. Patients are usually familiar with the necessary care of dentures to prevent infection and irritation, and prefer to perform denture care according to standard practice at home.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Assisting the Patient with Oral Care

See the competency checklist for Assisting the Patient with Oral Care. You can find the checklists on the Student resources tab of your book page on openstax.org.

Eyes, Ears, and Nose

Special attention is given to care of the eyes, ears, and nose due to the sensitivity or these areas, and taking exceptional care to avoid injury is important. The nurse should ask the patient about any specific care the patient normally performs in relationship to the eyes, ears, and nose. For example, some people prefer using cotton swabs to clean the outer parts of the ears. The nurse should also be aware of any use of hearing or visual aids, such as eyeglasses, hearing aids, or contacts. The nurse should also ask the patient about any history or treatments of eye, ear, or nose problems.

The circular areas around the eyes are usually cleaned during the bath with the use of a clean washcloth, moistened with warm water. Soap may cause burning or irritation, so avoiding soap around the eyes is advisable. The eye should be cleaned from the inner to outer canthus. A separate section of the rag should be used each time to avoid the risk of spreading infection. If the patient has dried exudate (dried or crusty fluid) that is not easily loosened, try placing a damp gauze or cotton ball on the lid margins to loosen secretions. Avoid applying direct pressure over the eyeball as this may cause injury. Remove any exudate from the eyes carefully and as often as needed to keep the

eye clean. Unconscious patients may require more frequent eye care due to the buildup of secretions from the absence of the blink reflex.

The ears are also cleansed during a shower or bed bath. The ear canal should be cleaned with a gentle rotation using a moistened washcloth. A cotton swab is useful for cleaning the pinna or outer aspects of the external ear. Educating patients to never use toothpicks, cotton swabs, or any other device to clean the internal auditory canal is important, as the tympanic membrane can easily be damaged through this action.

Care of the nose includes clearing secretions. Most patients are able to gently blow into a disposable paper tissue. The individual should avoid harsh blowing as this can cause pressure capable of injuring the nasal mucosa, sensitive eye structures, and the tympanic membrane. The patient should blow with both nostrils open to avoid forcing debris into the eustachian tubes. If the external nares are crusted, a warm, moist compress may be used to help soften and remove any exudate. A moist washcloth or cotton swab may be used to clean the opening of the nares but should never exceed past the nares to avoid injury.

Contacts and Glasses

Eyeglasses are often expensive and are the patient's personal property. Therefore, eyeglasses should be stored in a case or bedside drawer when not in use to prevent damage or loss. Eyeglasses may require special cleaning with the use of cloths made of soft microfiber, cleansing solutions, or lens wipes. Washcloths, paper towels, and tissue paper should be avoided because they can scratch the lenses.

Various types of contact lenses are available, ranging from daily, weekly, or even monthly use. Some patients may sleep in contact lenses, while others cannot or prefer not to leave these lenses in the eyes overnight. The nurse must assess the type of contacts the person wears and any preferred special care measures. Several products are available for lens care, such as saline solutions and hydrogen peroxide solutions. Most patients will prefer to care for their own lenses but should not wear these contacts if unable to independently insert and remove the lenses. Contacts should remain clean and sterile. Reusable lenses should soak in a solution of the owner's choosing when not in use to keep the lens from drying out. Hand hygiene when inserting or removing contacts is essential to prevent infection. A towel may be placed in the sink to prevent a dropped contact from accidentally falling into the drain.

Hearing Aids

Hearing loss is a common health problem. The ability to hear impacts a person's ability to communicate and react appropriately to things in their environment, and many patients have hearing aids (Figure 7.2). The care of hearing aids includes battery care, proper insertion, and routine cleanings. The nurse should determine the patient's normal method of cleaning the hearing aids. In addition, the nurse should assess the quality of the patient's hearing with the use of the devices to ensure effectiveness and functionality. The hearing aids should not be used when water exposure is a risk to avoid damage to the devices. When hearing aids are not in use, the devices should be labeled and stored in a case or a safe place to avoid damage or loss. The battery should also be removed or turned off when not in use to preserve the battery life. The hearing aids may be cleaned with a dry, soft cloth.

FIGURE 7.2 Hearing aids come in various styles. These supplemental devices work by using parts to amplify sound in an individual's environment and channel it into their ear. The parts include a microphone to detect the sound, an amplifier to make the sound stronger, a speaker to send the sound into the ear, and a battery to provide power to the electric parts. (credit: modification of work "HearingAidTypes" by Wikimedia Commons, Public Domain)

Hair

Hair care will depend greatly on the patient's preferences, culture, and physical and cognitive limitations. Hair should be shampooed as often as necessary or per individual preference. The brush and comb should be washed each time the hair is washed, or as appropriate. Prior to shampooing the hair, brush or comb the hair to stimulate the scalp and untangle hair. Whenever possible, encourage the patient to brush and wash their own hair. In the event regular shampooing is contraindicated for various conditions, bedside products such as foams, dry powders, or concentrates that do not require rinsing may be used. Shampoo caps are also available and should be warmed in the microwave if they are not stored in a warmer. Once the cap is on the patient's head, massage the hair and scalp to lather the shampoo per manufacturer's directions, and discard after use. Towel dry the hair after each type of cleansing, followed by combing and styling to the patient's preference. If the person requests, an electric razor can be provided. If a hair dryer is not appropriate or available, the hair should be covered with a towel until dry to minimize the individual becoming chilled. Some healthcare facilities, such as a skilled nursing facility, may have beauticians or barbers to assist with hair care but this does not dismiss the nurse of obligation.

Hair type should also be considered with hair care. For tightly curled hair, a wide-toothed comb is best to untangle the hair, working from the neckline to the forehead. This hair type may also prefer small braids that do not need to be undone for shampooing. Application of a lubricant oil should be applied to the braids to prevent hair breakage. Those individuals with alopecia and/or baldness should still cleanse and moisturize the scalp to prevent dryness. Dandruff may also be present and is not considered contagious or infectious. Dandruff and hair loss may be embarrassing for a patient, so the nurse must remain professional and preserve the person's dignity.

Nails

Nails may harbor bacteria, so maintaining nail care to prevent the risk of infection or injury from scratching is crucial. Nurses must follow the agency's policy related to nail care, as some facilities do not allow nail trimming by clippers. If allowed, nails should be trimmed straight across then rounded at the tips in a gentle curve. The nails should not be trimmed too short as the skin and cuticles may become injured. Hangnails, which are broken pieces of cuticle, should be cut off with cuticle scissors and not torn or ripped off. Cuticles should be gently pushed back, after softening by washing with warm water, using a terry cloth or blunt instrument. A moisturizer or emollient may be applied to the nails and cuticle to prevent hangnails. The underside of the nails should be cleaned with a blunt instrument or nail brush. Damaging the area where the underlying tissue and nail are attached by being forceful is discouraged. Once the care is completed, a massage to the hands using lotion may increase blood flow and provide comfort.

Feet

Feet also require special attention to prevent odors, injury, and infection. Poor care of the feet may result in conditions such as calluses, neuropathy, pain, ingrown toenails, or deformities (such as hammertoe). Feet may be cleaned in the shower or using a basin with tepid water and mild soap for bedside baths. The feet should not be soaked. Feet should be dried immediately after being washed. Lotion may be applied and massaged on the feet to promote circulation and provide comfort. In the presence of athlete's foot, an antifungal foot powder should be ordered and used for treatment. Toenails should also be kept short to minimize bacteria underneath the nail. Care of the toenails is very similar to the care of fingernails. In some facilities, only the registered nurse may be allowed to trim the toenails of patients with diabetes, using a nail file to reduce the risk of trauma or injury. The patient with diabetes may have reduced sensation in their feet and must be taught how to examine and care for the feet daily. Some patients may need to see a podiatrist for treatment of corns, calluses, or bunions. The nurse should also educate the individual or ensure the use of cotton socks for warmth and perspiration absorption, as well as the importance of properly fitting footwear to avoid complications.

LINK TO LEARNING

The ADA provides a reference for daily foot care tips (https://openstax.org/r/77FootCareTips) as diabetes can alter a person's ability to feel pain, heat, or cold in their feet. This leaves an individual susceptible to injury or infection. Therefore, it is essential that the nurse educates the patient on proper foot care.

Perineal and Vaginal Care

Care of the genitalia, called perineal care, is part of a complete shower or bath. Patients who are able to perform hygiene independently may prefer to cleanse on their own. Those persons not able to perform this practice independently may request someone of the same gender to assist with perineal care or a bath in general. This request must be communicated and followed as best as possible. Patients who require help may include those who have physical or cognitive limitations. Individuals who are postpartum, recovering from rectal or genital surgery, or have an indwelling catheter require meticulous care to avoid infection. Other instances that may also cause vaginal or perineal problems include douching, some sexually transmitted infections, diabetes mellitus, and urinary or fecal incontinence. Maintaining a professional attitude, preserving the patient's dignity, ensuring privacy, and gaining permission to touch the patient is important when aiding in perineal care regardless of consciousness. The nurse needs to remember to always clean from the least contaminated areas to the most contaminated areas to prevent infection.

Sitz baths may also be used after childbirth, rectal surgery, or vaginal surgery. This treatment may also be used to relieve discomfort from a fissure or hemorrhoids. A sitz bath is most often performed on the toilet with a tub lining the bowl. The tub is filled with three to four inches of warm, not hot, water. The patient will submerge the pelvic area for twenty to thirty minutes to aid in reducing inflammation. Other options for cleansing the perineal and vaginal areas of a patient who is postpartum include either a shower or sitting on a stool using a perineal irrigation bottle.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Performing Perineal Care

See the competency checklist for Performing Perineal Care. You can find the checklists on the Student resources tab of your book page on openstax.org.

Catheter Care

Catheters come in many forms, such as internal (indwelling and Foley catheters) and external (wick and condom catheters). For patients with an indwelling catheter, powders and lotions should be avoided after cleaning. Betadine, antibiotic, or other microbial cleaners should be avoided at the urethral meatus. Catheter care is usually performed after perineal care and is usually ordered twice daily. Nurses should pay close attention to how long the catheter has been inserted and request confirmation from the provider to remove the catheter as soon as possible if it needs removal. Prompt removal and precise cleaning can help to avoid an associated infection. According to the CDC, catheter-associated urinary tract infections (CAUTIs) have been cited as the number one healthcare-associated infection (HAIs) (Werneburg, 2022). Patients with fecal incontinence may require more frequent cleanings. Nurses wear clean gloves and perform hand hygiene before and after caring for the patient. The catheter should always be cleansed gently from the meatus outward using mild soap and running water. Each stroke should use a clean portion of the washcloth or disposable wipe.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Performing Catheter Care

See the competency checklist for Performing Catheter Care. You can find the checklists on the Student resources tab of your book page on openstax.org.

LIFE-STAGE CONTEXT

Menstrual Hygiene

Patients who experience menstrual cycles will need proper menstrual hygiene. There are various products available such as pads, tampons, cups, sponges, and padded underwear or briefs. Some cultures practice free bleeding. Assessing the patient's preferences for the type of products normally used for these purposes is important. Sanitary

pads and briefs should be changed every few hours or more frequently depending on the menstrual flow. Tampons should be changed every four to eight hours or more frequently with heavier flows. Menstrual cups should be cleaned daily after use and can be sanitized by rinsing thoroughly and boiling in water for one to two minutes or per manufacturer guidelines. Period underwear should be washed per manufacturer instructions. The risks associated with improper menstrual hygiene can lead to yeast infection, toxic shock syndrome, rash, irritation, and impaired skin integrity. The nurse must assess the patient's knowledge and preferences, as well as provide education about menstrual hygiene.

Special Focus on the Older Adult

Life span considerations for the older adult include age-related changes that require special focus and nursing strategies. Age-related changes include impaired physical mobility, impaired oral mucous membranes, and an increased risk for impaired skin integrity. Older adults are also more likely to become chilled when left uncovered during bathing. The room should be maintained at a warmer temperature, and drapes should be used during care to provide modesty and avert chilling. Older adults also may experience neurologic changes or impaired circulation that impede the ability to sense temperature changes in water. Using caution to prevent burns or injury to the skin is also important to remember. In addition, frequent bathing and use of soaps may have harmful effects on the skin.

Age-Related Changes

Impaired physical mobility related to aging includes decreased dexterity and muscle strength, chronic conditions that compromise functional mobility, and decreased range of motion. Some examples of chronic conditions that compromise functional ability include heart disease, diabetes mellitus, rheumatoid arthritis (RA), coronary heart disease, chronic obstructive pulmonary disease (COPD), and osteoarthritis. Patients with deficits after a stroke, Parkinson disease, or other neurologic disorders may also experience physical limitations.

Part of the aging process also includes a loss of elasticity, reduced blood supply to connective tissue, and degeneration of epithelial cells that lead to impaired mucous membranes. Older patients are also likely to have impaired oral mucous membrane due to the decreased production of saliva and medications that cause dry mouth. For example, decongestants, antidepressants, antihistamines, blood pressure medications, Alzheimer disease medications, analgesics, and diuretics may cause dry mouth.

Older adults are also at risk for impaired skin integrity due to the loss of elasticity, thinning of the epidermis and subcutaneous fat, and dryness caused by decreased activity of oil and sweat glands. The older adult's nails may become opaque, brittle, scaly, tough, or hypertrophied. These skin-related changes may also be visible in the feet. Older adults are at an increased risk of friction shear and pressure ulcers due to age-related skin changes and impaired mobility.

Nursing Strategies

Nursing strategies for patients with impaired physical mobility include ensuring patient safety. For example, grab bars, adequate lighting, and nonslip mats in the bathrooms should be available to reduce the chances of falling or injury. Providing frequent rest periods, and scheduling hygiene sessions after periods of rest can ensure the patient does not become overly exhausted. Older adults may benefit from adaptive hygiene devices such as a long-handled body sponge, shower chair, large or extended handled toothbrushes, and grab bars (Figure 7.3). Physical therapy, or exercise, and occupational therapy may also be needed to aid in activities of daily living and help patients retain their independence by improving their mobility and functionality.

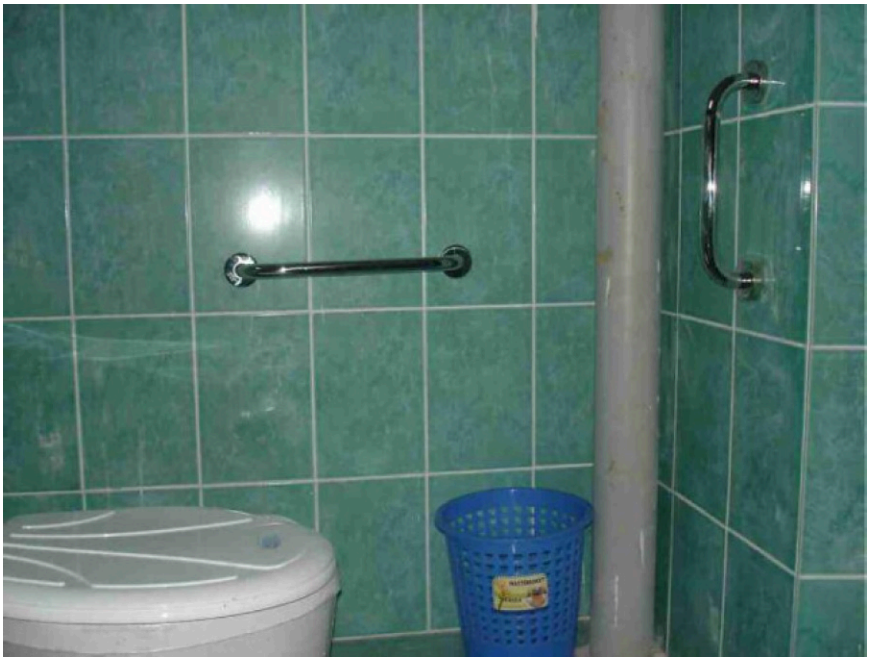


FIGURE 7.3 Grab bars are a great way to prevent falling in older adults who have balance issues. (credit: Untitled by Unknown/Flicker, CC BY 2.0)

Good oral hygiene measures may aid in the preservation of the older person's ability to eat and can also reduce the alteration in taste common with aging. Patients should be encouraged to have dental exams every six months and should avoid spicy, acidic, coarse, and sugary foods that may cause dental caries. Mouthwashes that contain alcohol should also be avoided. Nurses should also encourage or aid with brushing teeth with fluoride toothpaste twice a day. Dentures should be brushed twice daily and rinsed with cool water. Other strategies include rinsing the mouth after meals, examining the mouth daily to check for inflammation and lesions, and applying lubricant to lips. Patients may have sugar-free gum or candies and salivary substitutes, such as mouth sprays, gel, swabs, dissolving tablets, or an oral rinse.

Maintaining skin integrity is essential to ensure the integumentary system is able to properly perform its functions of protection, sensation, heat regulation, excretion, secretion, and absorption. For example, the nurse can incorporate strategies for how hygiene can be tailored to keep the patient warm, such as keeping a blanket over the patient while exposing one body part at a time for personal care. The nurse can also perform bathing as quickly as possible and place a warm blanket on the exposed individual immediately after the bath. Because older adults are more susceptible to friction shear and other injuries, the bedding should be wrinkle free, clean, and dry. Draw sheets should be used when repositioning or moving patients to avoid skin injury as well. Water temperature for bathing should be monitored to ensure the temperature is tepid and not hot. Older patients who are able should use showers and avoid bathtubs as this method can dry out the skin. The skin should be rehydrated with lotions or emollients daily while avoiding excessive amounts. Any excessive amounts of lotions of emollients should be wiped off to avoid skin breakdown. Older adults should also be encouraged to drink hydrating fluids to aid in hydrating the skin. Because frequent bathing and the use of detergent soaps can be harmful to the skin, bathing should be regular but not every day and pH-balanced skin cleansers should be used.

UNFOLDING CASE STUDY

Unfolding Case Study #2: Part 3

Refer back to Unfolding Case Study #2: Part 1 to review the patient data.

Nursing Notes	**1030:** After speaking with the charge nurse about concerns, patient's daughter is visibly upset. She is crying and states, "I just feel so helpless. I want to be here to be the one to help him to the bathroom and keep him clean, but I can't. I work fifty hours a week and barely see my own kids. I just don't know what to do." **1400**: Patient educated on how to call nursing staff when he needs to use the bathroom. Patient expresses understanding and agrees to call.
Flow Chart	**1030: Assessment** Blood pressure: 128/81 mmHg Heart rate: 93 beats/minute Respiratory rate: 20 breaths/minute Temperature: 99.1°F Oxygen saturation: 98% on room air

5. Take action: What strategies could the nurse use to comfort the patient's daughter?
6. Evaluate outcomes: The nursing staff agrees to check on patient every two hours to see if he needs to use the bathroom and patient agrees to use call light if he needs to go. What outcomes would the nurse expect to see if these interventions were successful?

Promoting Health through Education

One of the most essential roles nurses have in disease prevention and health promotion is through education. The nurse should assess a patient's knowledge about hygiene as well as individual cultural and personal preferences. The nurse should educate people on the importance of good hygiene practices. For example, promoting medical asepsis prohibits the growth of pathogenic microorganisms, which leads to decreased chances of infections. In addition, good hygiene can aid in preventing the spread of diseases to others, promote self-esteem, and boost mood. Once the nurse assesses the patient's knowledge and ensures understanding, the nurse should educate the person on the steps needed to perform hygiene to avoid infection or injury. The nurse should also assess a patient's ability to perform care independently via performing a head-to-toe assessment. The nurse should reinforce proper steps as needed while educating and giving instructions on the importance of diet and nutrition to promote healthy skin and mobility.

PATIENT CONVERSATIONS

What If Your Patient Does Not Have Adequate Knowledge about Oral Hygiene?

Scenario: Nurse walks into the newly admitted patient's room to determine hygiene needs. The patient is a college student that has not seen a dentist in a few years and has red, inflamed gums.

Nurse: Hi, my name is Marie, and I am going to be your nurse today. Do you mind verifying your name and date of birth?

Patient: My name is Sarah Milton, date of birth December 4, 2003.

Nurse: Thank you. I am going to ask you a few questions about your personal hygiene. Is that okay?

Patient: What is personal hygiene? Like how I do my private care? I'm confused.

Nurse: Personal hygiene is the self-care measures you would perform such as bathing, brushing and flossing your teeth, hair care, and nail care.

Patient: Well, I let my roommate do my nails, since she is in cosmetology school. I shower almost daily and wash my hair every other day. I brush my teeth a few times a week and never floss.

Nurse: Okay, when was the last time you saw a dentist?

Patient: I don't know, maybe two or three years ago. I was still in high school, and my mom made me go.

Nurse: Have you ever had cavities, gingivitis, or any other dental issues?

Patient: I do not know what gingivitis is. My gums bleed when I brush them, which is why I do not brush as much. I remember the dentist made me use a special mouthwash once. I had several cavities as a kid. I think I had to get fillings at almost every visit.

Nurse: Gingivitis is inflammation of the gums. If left untreated, it can lead to periodontal disease that can ultimately lead to loss of teeth due to infection and deterioration of the gums. If infection entered the bloodstream, it could also increase the chances of stroke, heart attack, or other serious events. Signs of gingivitis include swollen gums, reddened gums, gums that bleed easily with brushing or flossing, bad breath, and tender gums. I know you said your gums bleed easily. Do you experience any of the other symptoms?

Patient: Yeah, my gums are pretty tender. I have never looked for the other things though.

Nurse: Okay, do you mind if I examine your mouth?

Patient: Sure.

Scenario follow-up: Upon examination, the nurse noted a foul odor, visible food particles in the patient's mouth, and reddened, swollen gums.

Nurse: You do have reddened, swollen gums with food particles present. Food left in between teeth can cause irritation and inflammation. Flossing will aid in the removal of food particles, plaque, and tartar. Seeing a dentist for examination and professional cleaning to remove plaque, tartar, and bacteria regularly will aid in the prevention of dental issues as well. I will go over oral care with you and demonstrate the steps to perform twice a day as well as rinsing your mouth after meals. I will also provide you with a mouthwash to use while you are here.

Patient: Okay, great. Thank you. My parents did not tell me any of this. I do not want my teeth to fall out.

Summary

7.1 Hygiene Practices

Hygiene measures can support health and prevent disease. Hygiene practices include but are not limited to the care of the skin, hair, nails, oral cavity, and perineal areas. The lack of adequate hygiene practices may lead to various hygiene-related diseases or infections such as lice (body, hair, and pubic), tooth decay, scabies, pinworm infection, ringworm, trachoma, swimmer's ear, urinary tract infection, gingivitis, and periodontitis. There are many benefits to adequate hygiene, such as preventing infection while preserving mental and physical health. Good hygiene and self-care practices may enhance mood, reduce stress levels, promote a sense of well-being, prevent or limit anxiety, boost an individual's self-esteem, and positively impact relationships.

7.2 Factors Influencing Personal Hygiene

There are various factors that impact a person's personal hygiene. Cultural practices, socioeconomic status, developmental level, and personal preferences greatly influence an individual's hygiene. These factors may differ from person to person. For instance, cultural preferences can greatly impact how a person performs hygiene in terms of products used, frequency, and touch. Socioeconomic status greatly impacts how hygiene is performed by an individual due to financial limitations, product availability, and access to bathrooms or water. Developmental level can impact personal hygiene throughout the life span. Children through older adults will experience changes in their bodies that may impact the skin, mobility, and effectiveness of performing personal hygiene. Personal preferences play a large role in someone's hygiene practices. Preferences may include timing, frequency, type of products used, use of bathtubs versus showers, nail length, hair length, and hair oiliness. Physical factors, such as a person's mobility status and health state, can potentially interfere with personal hygiene practices throughout one's life. Psychological factors, such as confusion, depression, mental health crises, or even stress from a negative self-image can also influence personal hygiene or prevent an individual from taking care of their body. Remembering to remain nonjudgmental when speaking with patients about personal hygiene practices and preferences is important for nurses. Keep in mind that hygiene or lack of hygiene can be indicative of a person's mental state.

7.3 Assisting with Hygiene and Health Promotion

Prior to assisting with hygiene and health promotion, the nurse must analyze the patient's preferences, ability to perform or if and how much assistance is needed, and physical and cognitive status. The nurse must also consider the Five Rights of Delegation prior to delegating tasks: right task, right circumstance, right person, right directions and communication, and right supervision and evaluation. Hygiene practices should always include a baseline assessment to check for lesions, infections, secretions, or other impairments or abnormalities. The patient's privacy and dignity should also be maintained. The patient's dignity can be preserved by a professional, matter-of-fact attitude. Oral care may include flossing teeth and brushing teeth, gums, tongue, cheeks, and roof of mouth. It may also include denture care and mouth rinses. Careful cleaning is necessary for the eyes, ears, and nose to preserve their sensory functionality. Care may also be needed for contact lenses, eyeglasses, or hearing aids. Hair care will depend greatly on the patient's preferences and hair type. Nail and foot care should be carefully provided to avoid injury, and nails should be trimmed short to prevent injury or infection. Perineal and vaginal care must be carefully provided to avoid infection or other vaginal and perineal problems. Life span considerations for the older adult include age-related changes that require special focus and nursing strategies. Age-related changes include impaired physical mobility, impaired oral mucous membrane, and the risk for impaired skin integrity. Nurses can promote health through education by ensuring or reinforcing a patient's knowledge, ability, and skills to carry out hygiene tasks.

Key Terms

cultural sensitivity recognizing and acknowledging that cultural differences exist among people and showing respect and appreciation for others' beliefs, values, practices, and perspectives

dentures artificial teeth not permanently implanted

gingivitis inflammation of the gums or gingivae

halitosis persistent foul-smelling or bad breath

hygiene the measures or practices conducive to preserving health and preventing disease, particularly through cleanliness

medical asepsis techniques and procedures used to decrease the potential for the spread of microorganisms and infection
oral hygiene care of the oral cavity
otitis externa an infection or inflammation of the external ear canal, usually caused by water exposure or bacterial/fungal infections
pediculosis lice infestation
periodontitis marked inflammation of the gums that also involves degeneration of the dental bone and tissues
personal hygiene self-care measures one performs to preserve their own health
pinworm an intestinal worm that usually spreads when an infected individual scratches the anal area
ringworm a fungal infection of the skin or scalp
scabies a contagious skin infestation caused by a burrowing mite accompanied by extreme itching
sebum an oily secretion of the sebaceous gland
skin breakdown the damage or injury that occurs to the skin and underlying tissue due to prolonged pressure, friction, shear, or moisture
tooth decay visible cavities or holes in the outer surface of a tooth or enamel
trachoma a bacterial infection of the eyes
urinary tract infection an infection of any part of the urinary system (urethra, bladder, or kidneys)

Assessments

Review Questions

1. A nurse caring for patients in a long-term living facility knows that providing good oral hygiene is an essential part of nursing care. What is the benefit of providing oral hygiene?
    a. It eliminates the need for flossing.
    b. It compensates for poor nutrition.
    c. It promotes a sense of well-being.
    d. It decreases oropharyngeal secretions.

2. A nurse is scheduling hygiene for patients on the medical-surgical unit. What should be the nurse's priority consideration when arranging a patient's personal hygiene?
    a. where the hygiene fits in with the nurse's schedule
    b. the best time for the patient care technician to aid with the patient's hygiene needs
    c. the patient's personal hygiene practices and preferences
    d. the outside temperature

3. A patient presents to the primary care office with complaints of constant itching of scalp and hair. The patient states that they recently noticed insects in their hair after spending the day volunteering at a shelter. What does the nurse know the patient is more than likely experiencing?
    a. pediculosis
    b. dry scalp
    c. folliculitis
    d. gingivitis

4. What is true about older adults' saliva?
    a. Older adults have a decreased production of saliva.
    b. Older adults have an increased production of saliva.
    c. Older adults have no change in saliva production.
    d. Older adults have a change in the color of their saliva.

5. What is another term for the clean technique?
    a. personal hygiene
    b. surgical asepsis
    c. medical asepsis

d. sepsis

6. What is *not* an example of hygiene personal preferences?
   a. time of day
   b. frequency
   c. shampoo brand
   d. financial status

7. What can being aware that cultural differences and similarities between people exist without assigning them value be defined as?
   a. cultural sensitivity
   b. cultural insensitivity
   c. cultural diffusion
   d. cultural appropriation

8. A 72-year-old patient with Alzheimer disease is a new admission to a long-term facility. The patient presents with an odor, soiled clothing, and greasy hair. What does the nurse need to consider prior to scheduling a bath for this patient?
   a. the last time the patient told the nurse they had a bath
   b. where the patient is in their disease progression
   c. the temperature outside
   d. the patient's financial status

9. When aiding a patient who is paralyzed and bedridden, what does a nurse need to recognize that the hygiene will not do?
   a. decrease comfort
   b. increase comfort
   c. control odor
   d. protect the skin

10. What is the top priority with nursing strategies and hygiene?
   a. patient ethnicity
   b. safety
   c. patient-to-staff ratios
   d. when the patient will discharge

11. A 77-year-old patient with Alzheimer disease is a new admission to a long-term facility. The patient appears under distress during bathing. What guidelines should the nurse consider?
   a. the last time the patient said they had a bath
   b. demanding the patient take a bath
   c. playing calming music and reassuring the patient
   d. scrub hard and fast

12. What should the nurse do prior to providing patient education about health promotion?
   a. Gather information online about the patient's ethnicity.
   b. Assess the patient's current knowledge.
   c. Tell the patient the nurse's personal preferences.
   d. Tell the patient they have to perform hygiene a certain way.

13. When the nurse is performing perineal care on an uncircumcised male patient, what is not a step in the process?
   a. Gently grasp the shaft and retract the foreskin.
   b. Wash the tip in a circular motion.

c. Replace the foreskin.
d. Leave the foreskin alone.

Check Your Understanding Questions

1. Describe the benefits of good skin hygiene.
2. Describe hygiene-related diseases.
3. Describe how a person's socioeconomic status can impact personal hygiene.
4. Compare and contrast the physical and psychological factors that affect hygiene.
5. Describe the Five Rights of Delegation.
6. Describe age-related changes and nursing strategies related to impaired mucous membranes.

Reflection Questions

1. What information might you need to include when educating a patient about the importance of hygiene?
2. What information might you include when educating a new nurse about cultural preferences?
3. What information might you include when educating a recently admitted teenager who just started her first menstrual cycle?

Critical-Thinking Questions about Case Studies

1. Refer to Unfolding Case Study #2: Part 1.
   How would the nurse handle an upset family member who is threatening legal action?
2. Refer to Unfolding Case Study #2: Part 2.
   Why are older adults at higher risk for developing urinary tract infections?

What Should the Nurse Do?

1. A nurse is assessing a patient with oily hair and noticeable debris on their face and arms. The nurse also notices that the patient's gown is soiled. The nurse asks the patient when they last showered and if the patient would like to shower that morning or afternoon. The patient refuses to perform hygiene practices. What should the nurse do?
2. A 58-year-old patient has recently been admitted to the medical-surgical unit. The patient appears uncomfortable when the nurse asked if the patient would like to have a bath that day. What should the nurse do?

You are a home health nurse visiting a new patient. The patient is an 80-year-old male with diabetes who has impaired mobility after a stroke. The patient ambulates with a walker and was able to greet you at their door. The patient lives alone as his wife died last year. Upon entering the home, you notice clutter in various areas: a table covered in books, newspapers, dishes, and pictures; couches and chairs have clothing and miscellaneous medical equipment on them; and there are cords spread across walkways. The patient makes space for you to sit at the kitchen table and tells you it is ok to push anything aside that is in your way. While establishing rapport, you notice the patient has various body odors; soiled clothing; dry, flaky skin; and food particles visible in his teeth.

3. How would you address the patient's hygiene habits?
4. How would you address the clutter in the patient's home?
5. What would you educate the patient about regarding hygiene?
6. How would you respond if the patient tells you he prefers baths?
7. You are ready to develop a plan of care for this patient. What are three hygiene goals you can make?

Competency-Based Assessments

1. Develop a ten-minute presentation defining hygiene and explaining its benefits.
2. Prepare a fifteen-minute presentation to demonstrate performing a hygiene-focused head-to-toe assessment

of a patient's ability to perform personal hygiene independently.

3. Develop a five-minute presentation on promoting healthy hygiene habits through patient education.
4. Review the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 8

Wound and Burn Assessment and Care

FIGURE 8.1 Nurses apply different types of dressings depending on the type of wound and the ways the wound must be managed. For example, using a transparent dressing allows the nurse to monitor an insertion site for complications. (credit: "Mass casualty exercise 130512-A-WI517-091" by Spc. Vang Seng Thao/Wikimedia Commons, Public Domain)

CHAPTER OUTLINE

8.1 Wound Classification
8.2 Wound Assessment
8.3 Wound Management
8.4 Burn Injuries and Management

INTRODUCTION Wounds come in all shapes and sizes, from scrapes after a fall to gunshot wounds, ulcers related to pressure or insufficient circulation, and incisions after surgery or burns. Every human is impacted by wounds and every nurse must be able to effectively assess and manage them. This unit will discuss proper wound classification, assessment, and management. It will also discuss burn injuries.

8.1 Wound Classification

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the different classifications of wounds
- Recognize the risk factors for pressure injury development
- Describe the staging process for pressure injuries

A **wound** is defined as an injury that causes a disruption of normal skin or tissue integrity. Wounds can be typed as an **incision**, **contusion**, **abrasion**, **laceration**, **puncture**, **penetration**, **avulsion**, **burn**, and **ulcer** (Table 8.1). In order

to effectively manage wounds, nurses must first recognize the various wound classifications, as well as identify individuals at risk of pressure injury development, and describe the technique for staging pressure injuries.

Wound Type	Description
Abrasion	An area of skin or tissue damaged by scraping
Avulsion	A forcible tearing off of skin or another part of the body
Burn	Injury to the skin caused by thermal, electrical, chemical, or electromagnetic energy
Contusion	A region of injured tissue or skin in which blood capillaries have been ruptured (bruise)
Incision	A surgical cut made in skin or flesh
Laceration	A deep cut or tear in the skin or flesh or underlying tissue
Penetration	A wound caused by an object that pierces the skin and lacerates or damages adjacent tissue
Puncture	A wound made by a pointed object
Ulcer	An open sore caused by poor blood flow

TABLE 8.1 Types of Wounds

Different Types of Wound Classification

Wounds are classified in several ways and include intentional or unintentional wounds, open or closed wounds, acute or chronic wounds, pressure injuries, and friction and shear. Wounds also may be described according to how they were acquired, how long the wound has been present, or how deeply the wound affects the skin or tissues (Table 8.2).

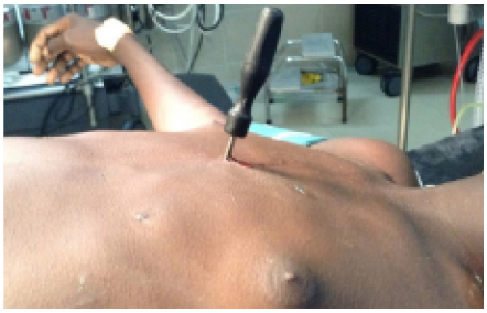
Classification	Description	Example
Intentional wounds	• Wounds are planned incisions as the result of a treatment or therapy. • Wounds serve a therapeutic purpose. • Wounds are clean with approximated edges and are performed under aseptic or sterile procedures. • Typically, the bleeding is well controlled and surgical incisions are closed immediately after the procedure. • Examples include surgical incisions, venipunctures, and lumbar punctures.	 (credit: “Hip replacement, surgical staples” by Karl-Heinz Wellmann/Wikimedia Commons, CC BY 3.0)
Unintentional wounds	• Wounds are from unexpected traumas and can result in multiple injuries. • The wounds are not acquired under sterile or aseptic conditions. • Wound edges are irregular and not clean like those of intentional wounds. • Bleeding is not controlled in this setting. • Examples include a broken bone or laceration from bicycle or automobile accidents, burns, work-related injuries, and penetrating wounds from a bullet or metal fragments.	 (credit: modification of “The Power of a Soccer Ball: A Traumatic Open Finger Dislocation-A Rare Case Presentation” by National Library of Medicine, CC BY 3.0)
Open wounds	• Wounds are breaks in the skin or mucous membranes caused either intentionally or unintentionally. • Wounds create an entry for microorganisms, which combined with tissue damage and bleeding increases the risk of a prolonged healing time and infection. • Examples include incisions, abrasions, punctures, lacerations, penetrating wounds, and avulsions.	 (credit: “Screwdriver penetrating the chest” by P. A. Dieng et al., CC BY 3.0)
Closed wounds	• Wounds result from a force or blow like from a fall, being hit by an object, or a collision with a person or inanimate object. • Examples include contusions and hematomas.	 (credit: “Plateletpheresis hematoma 2016” by "MajorB"/Wikimedia Commons, Public Domain)

TABLE 8.2 Wound Classifications

Classification	Description	Example
Acute wounds	• Wounds generally heal within days to weeks. • Wounds progress through the normal stages of healing without disruption. • Examples include traumatic injuries, burns, and surgical incisions.	 (credit: "Longitudinal mini-incision" by National Library of Medicine, CC BY 2.0)
Chronic wounds	• Typically, these wounds have jagged edges, higher risk of infection, and a delayed healing time of more than thirty days. • Wounds do not progress through the normal stages of healing and usually experience an interruption in the healing process. • Wounds generally stay in the inflammatory stage of healing. • Examples include pressure injures, diabetic ulcers, or ulcers from vascular insufficiency.	 (credit: "Bedsore ulcer" by Maria Kaz Leo/Wikimedia Commons, CC BY 4.0)

TABLE 8.2 Wound Classifications

Classification	Description	Example
Pressure injuries	• Injuries are localized ischemic lesions of the skin and underlying tissue caused by external pressure that impairs blood and lymph flow. • Lack of blood supply, oxygen, and nutrients to the tissues result in necrosis and eventual ulceration. This ischemia also leads to inflammation and edema. • Pressure injuries may also be called decubitus ulcers, bed sores, and pressure sores. • This type of wound can occur in as little as one hour and may be acute or chronic. • Pressure injuries often arise when the soft tissues are compressed between an external surface and a bony prominence or from friction or shearing forces that injure blood vessels and abrade the epidermis. • Examples of bony prominences include the heels, sacrum, coccyx, and greater trochanter.	 (credit: modification of “Escarre Stade 4” by "Essent"/Wikimedia Commons, CC BY 4.0)

TABLE 8.2 **Wound Classifications**

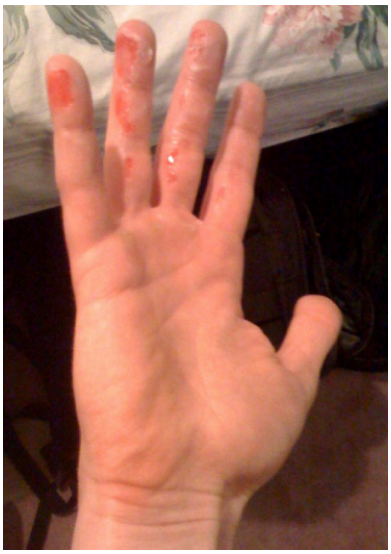
Classification	Description	Example
Friction injuries	• Injuries occur when two surfaces rub together, which generates heat and can remove the top layer of the skin, damage superficial blood vessels, and may look like an abrasion. • Examples include when a patient attempts to push themselves up in bed using their heels, arms, or hands or when personnel pull patients up in bed by a draw sheet or when transferring patients to a stretcher using a transfer or draw sheet.	 (credit: “Self-captured photograph of a rope burn (friction burn)” by "Jesusjonez"/Wikimedia Commons, Public Domain)
Shear injuries	• Injuries occur when one tissue layer slides over the other. • The shearing force separates the skin from its underlying tissues. Blood vessels stretch and bend or tear, causing injury, thrombosis, and impaired circulation to the tissue cells. • Examples include when patients are pulled when being moved up in bed, when patients are transferred from bed to stretcher or chair, or when a patient slides down when sitting in a chair or their torso slides down when sitting in bed and the head of the bed is elevated.	 (credit: modification of “Blister on toe” by Nadya Peek/Wikipedia, CC BY 2.0)

TABLE 8.2 Wound Classifications

Intentional and Unintentional Wounds

Intentional and unintentional wounds are described according to their acquisition. A wound that is planned and the result of a treatment or therapy is an **intentional wound**. Surgical incisions, venipunctures, and lumbar punctures are examples of intentional wounds that are necessary for a specific treatment. The wounds are made in sterile conditions, and any bleeding is well-controlled, which promotes adequate healing time and reduces the risk of infection. For example, surgical incisions are made deliberately with careful techniques and in aseptic conditions, then closed immediately after the procedure.

A wound from an unexpected trauma is called an **unintentional wound** (e.g., a broken bone or laceration from bicycle or automobile accidents, burns, work-related injuries, or penetrating wounds from a bullet or metal fragments). These types of injury can result in multiple areas of trauma and involve tissue loss. The wounds are not acquired under sterile or aseptic conditions. Wound edges are irregular and not clean like those of intentional wounds. Bleeding is not controlled in this setting. Individuals who require medical attention may experience a delay in getting emergency help depending on location, availability to call for help or other resources, and if anyone nearby is able to help control blood loss. These conditions create the potential for a longer healing process and an

increased risk of infection.

Open and Closed Wounds

A wound that breaks the skin or mucous membranes and is caused either intentionally or unintentionally is an **open wound**. Open wounds create an entry for microorganisms. This, combined with tissue damage and bleeding, increases the risk of a prolonged healing time and infection. Examples of open wounds include incisions, abrasions, punctures, lacerations, penetrating wounds, and avulsions. Furthermore, the term *open wound* is sometimes used to convey that the wound is not covered or dressed with bandages. It may even be left open to the air as part of the treatment process.

A wound that does not have a break in the skin and occurs under the skin's surface is a **closed wound**. Nevertheless, there may be bleeding, tissue damage, and internal injury under the skin's surface. Closed wounds may result from a force or blow like from a fall, being hit by an object, or a collision with a person or inanimate object. Examples of closed wounds include contusions and hematomas. Sometimes the term *closed wound* may relate to how wound edges are brought together. An example is when nurses say the wound is closed with sutures or staples.

Acute and Chronic Wounds

Another way to classify wounds is by acute versus chronic. A wound that occurs suddenly and progresses through expected stages of healing is called an **acute wound**. These wounds should be assessed based on the way they occurred and the anatomical damage (Nagle et al., 2023). Often the full extent of acute wounds is unknown until several days after an injury. Initial issues such as swelling may mask the true extent and even depth of the wound.

When patients with acute wounds present to a healthcare facility, the following wound assessments should be completed (Nagle et al., 2023):

- length of time since occurrence
- damage to underlying nerves, muscles, bones, and structures
- potential for contamination of the wound
- date of patient's most recent tetanus shot

Nurses should expect to assist with patient care including potentially (Nagle et al., 2023):

- providing oral, topical, and/or IV antibiotics
- assisting with wound cleaning (such as irrigation)
- assisting with tissue repair (such as sutures)

In contrast to acute wounds, an **chronic wound** is a wound in which little to no healing occurs for at least three months (Bowers & Franco, 2020). There are a variety of ways and reasons that wounds become chronic (Table 8.3). For caregivers, these are complex to manage and may never heal completely. The goals of care for chronic wounds are to determine why the wound is not healing and identify strategies to overcome those reasons and allow the wound to heal (Nagle et al., 2023).

Cause	Explanation
Arterial insufficiency (such as scleroderma or Reynaud disease)	Insufficient arterial blood flow to the extremities impacts the transportation of oxygen and even antibiotics to diseased tissues.
Venous insufficiency	Insufficient return of blood from the extremities causes increased pressure and fluid in intravascular spaces, decreasing the body's ability to heal effectively.
Infection	Infections in tissues and bones (cellulitis and osteomyelitis, respectively) prevent the healing process. Expect to culture for biological, viral, and fungal agents.

TABLE 8.3 Causes of Chronic Wounds (Source: Nagle et al., 2023.)

Cause	Explanation
Pressure	Constant or frequent pressure against healing tissues impacts the ability to heal and/or tears healing tissues back open.
Radiation therapy	Radiation may cause occlusion or damage to blood vessels, impacting healing of localized tissues.
Systemic diseases	Diseases such as diabetes and immunodeficiencies may impact the body's ability to heal naturally.
Nutrition	Protein malnutrition and elevated glucose levels can impact healing.
Age and hormones	While older age may lengthen the time it takes for an acute wound to heal, it does not cause chronic wounds. However, differences in androgens and estrogen may impact healing.
Medications	Several medications, including hydroxyurea, chemotherapeutic agents, and steroids, can slow healing.
Genetic issues	There is a genetic predisposition to issues such as keloid scarring and other skin conditions that may negatively impact wound healing.

TABLE 8.3 Causes of Chronic Wounds (Source: Nagle et al., 2023.)

Pressure Injury

A localized ischemic lesion of the skin and underlying tissue caused by external pressure that impairs blood and lymph flow is called a **pressure injury**. The lack of blood supply, oxygen, and nutrients to the tissues results in necrosis and eventual ulceration. This ischemia also leads to inflammation and edema. Pressure injuries may also be called decubitus ulcers, bed sores, and pressure sores. This type of wound can occur in as little as one hour and may be acute or chronic. Healthy people who have full control of their limbs make changes in their position constantly. However, when someone remains in the same position for an extended period of time, an injury occurs. The portion of the skin where the patients' weight and force are applied, is injured. Pressure injuries often arise when the soft tissues are compressed between an external surface, such as a bed or chair and a bony prominence or from friction or shearing forces that injure blood vessels and abrade the epidermis. Examples of bony prominences include the heels, sacrum, coccyx, and greater trochanter. Pressure injuries may occur in home settings, hospitals, and long-term care facilities. Pressure injuries require aggressive intervention and treatment to decrease unwarranted pain or discomfort, inhibit further tissue damage, accelerate wound healing, decrease length of stays, and decrease healthcare costs.

Friction and Shear

Friction and shear are mechanical forces that tear and injure blood vessels and can contribute to the development of pressure injuries. When two surfaces rub together, which generates heat and can remove the top layer of the skin, damage superficial blood vessels, and may look like an abrasion is called **friction**. Friction injuries may occur when a patient attempts to push themselves up in bed using their heels, arms, or hands. This can also happen when patients are pulled up in bed by a draw sheet or transferred to a stretcher using a transfer or draw sheet.

When one tissue layer slides over the other a **shear** results. The shearing force separates the skin from its underlying tissues. Blood vessels stretch and bend or tear, causing injury, thrombosis, and impaired circulation to the tissue cells. Shear injuries may occur when patients are pulled when being moved up in bed or transferred from bed to stretcher or chair. Shear injuries may also occur if a patient slides down when sitting in a chair or their torso slides down when sitting in bed and the head of the bed is elevated.

LIFE-STAGE CONTEXT

Life Span Considerations for Older Adults

Part of the aging process occurs when changes in skin collagen makes skin less elastic. The subcutaneous and dermal tissues are thinner, and the patient often has reduced sensations of pressure and pain. This makes older adults more susceptible to friction and shear injuries. Careful considerations for the older adult include checking skin frequently to monitor for breakdown or tears, ensuring bedding and linens are dry and wrinkle free, padding bony prominences, and ensuring proper lifting technique when moving patients in bed or transferring out of bed.

Risks for Pressure Injury Development

Pressure injuries may result from pressure, friction, and shearing forces but may also be caused by other factors. The risk factors for pressure injury development include moisture exposure, nutrition and hydration, mobility, and level of cognition. Other factors that may contribute to pressure injuries include the following:

- advanced age
- poor skin hygiene
- loss of sensation
- fractures
- immunosuppression
- diabetes
- history of corticosteroid use
- multiple organ dysfunction
- history of previous pressure injuries
- increased body temperature
- having a higher weight
- having a lower weight
- terminal illnesses
- end-of-life processes
- microvascular dysfunction

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Preventing Pressure Injury

See the competency checklist for Preventing Pressure Injury. You can find the checklists on the Student resources tab of your book page on openstax.org.

Moisture Exposure

Exposure to excessive moisture can cause skin **maceration** where the tissues are softened by the prolonged wetting or soaking. Macerated tissue makes the skin less resistant to trauma or pathogens and more susceptible to injury. Moisture from incontinence of feces or urine or gastric tube drainage promotes **excoriation**, the loss of the superficial layers of the skin, also known as denuded. The accumulation of excretions or secretions overhydrates the skin and makes it more alkaline. The moisture exposure irritates the skin, harbors microorganisms, and makes the skin more susceptible to breakdown and infection. In fact, any substance that is excessively applied that might overmoisten the skin can lead to skin damage. People who suffer from incontinence should be monitored for skin breakdown. Absorbent pads may be used to aid in protecting the linens from getting soiled. The patients should be cleansed as quickly as possible after each soiling; skin barriers may be used to protect intact skin (Shi et al., 2020). Examples of protective skin barriers include

- creams, emollients, and ointments;
- films and foams; and
- hydrocolloids and hydrogels.

Nutrition and Hydration

Nutrition and hydration play a major role in skin health. Cells that do not get adequate nutrition are more easily damaged. As a result of malnutrition, weight loss, muscle atrophy, and a decrease in adipose tissue can occur, resulting in the reduction of padding between the skin and bony prominences. Low protein in the blood, or **hypoproteinemia** leads to a negative nitrogen balance, insufficient calorie intake, edema, and electrolyte imbalances, which predispose the skin to injury. Protein is vital for wound healing as it serves multiple critical functions in the reparative process. It acts as the primary building blocks for collagen synthesis, facilitating the formation of new connective tissue essential for wound closure and tissue regeneration. Additionally, protein supports the proliferation and migration of cells involved in wound repair, such as fibroblasts and keratinocytes, enabling the formation of new tissue and the closure of the wound. Moreover, protein plays a crucial role in maintaining immune function, supporting the inflammatory response necessary for clearing debris and combating pathogens at the wound site. Protein is made up of nitrogen. Negative nitrogen balance means that the body is excreting more nitrogen than is being ingested. This will delay wound healing. Deficiencies in vitamin C may lead to frail capillaries and result in inadequate circulation, contributing to the development of pressure injuries. Edema and dehydration can also interfere with perfusion.

Mobility Status

Impaired mobility is a significant factor in pressure injury formation. People who have problems with mobility or are bedridden are unable to adjust themselves and may remain in one position for a prolonged period of time. People who have adequate mobility are able to move independently when they experience discomfort on an area of the body caused by pressure and also move freely in bed. People who are unconscious, have extreme weakness or pain, or have any other cause of decreased activity are unable to change positions and relieve the pressure even if their bodies sense the need to change position. Patients who require assistance in moving in bed or transferring are at risk of friction and shear injuries that may lead to pressure injuries if they are not properly lifted in the process.

Cognition Status

Consisting of the mental processes that take place in the brain such as thinking, language, learning, memory, perception, and attention is **cognition**. Patients who have an altered mental status or have decreased awareness (e.g., unconsciousness, sedation, or dementia) are at risk because they are less likely to recognize and respond to the discomfort from pressure. This means that medication or therapy that decreases a patient's mental status can increase their risk for pressure injuries. People who are more alert are more likely to respond to increased pressure, protect their own skin integrity, and perform adequate hygiene to prevent the development of pressure injuries.

Staging Pressure Injuries

Depending on the extent of damage, pressure injuries are assessed and classified as stages I through IV or as deep tissue or unstageable. Stage one is the least severe of the stages. It is essential for nurses to adequately stage pressure injuries to implement appropriate interventions and assess for improvement or worsening damage.

Blanching is part of the assessment process and can aid in identifying those at risk of pressure injury development. Normal **blanching** is temporary whitening or lightening of the skin around the wound site upon applying pressure. When the pressure is relieved, normal blood flow should return promptly to the area and return to the skin's normal color.

Prolonged pressure to an area makes it more difficult for adequate blood flow to return, thus resulting in pressure injuries. Patients who have been sitting or lying in a prolonged (e.g., two hours or more) position who are then repositioned may take sixty to ninety minutes for hyperemia (reddening of the skin) and warmth of the skin to resolve.

LINK TO LEARNING

The Spinal Cord Injury Research Evidence website has offers an excellent guide for the identification of pressure injuries, including pictures and appropriate terminology (https://openstax.org/r/77spinalcord) to use with all patients experiencing pressure injuries.

Stage I

A stage I pressure injury is characterized by localized, nonblanchable erythema of intact skin (Figure 8.2). Darker pigmented skin may not have apparent blanching, but the color of skin may differ from the adjacent skin. Purple or maroon skin discoloration may be indicative of deep-tissue pressure injuries and not a stage I pressure injury. The area may also be painful, soft or firm, or warmer or cooler than its neighboring tissues.

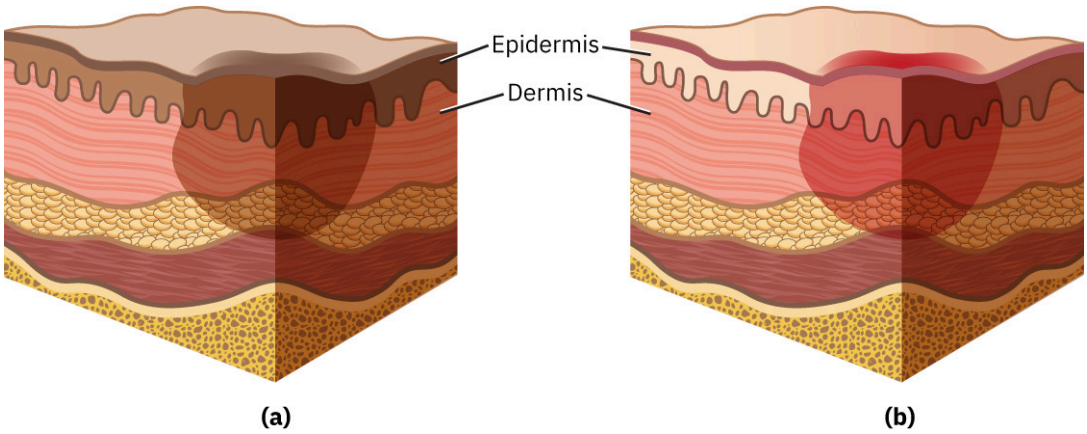


FIGURE 8.2 (a) In darkly pigmented skin, the area of concern is a different shade than the surrounding tissue. (b) In lightly pigmented skin, an area of pink and red erythema may be seen. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Stage II

Stage II pressure injuries are characterized by Partial-thickness (second-degree) skin loss involving the epidermis or dermis. The wound bed is viable, moist, red or pink, and may appear as an abrasion, shallow crater, or blister (Figure 8.3). The adipose and deeper tissues are not visible at this stage nor is **slough** (yellow, gray, green, tan, or brown dead tissue), **eschar** (hardened, black, tan, or brown necrotic tissue), or **granulation tissue** (delicate new reddish connective tissue or tiny blood vessels that bleed easily but provide the framework for scar tissue development).

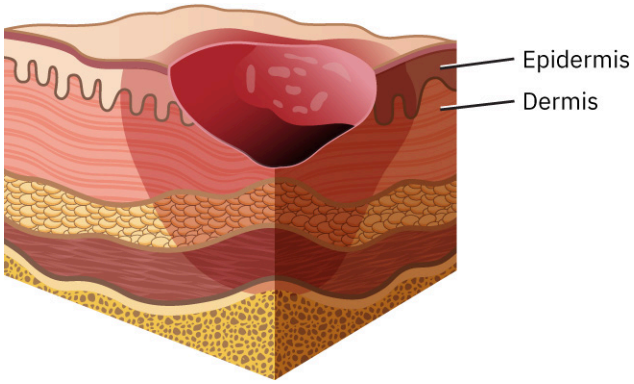


FIGURE 8.3 A stage II pressure injury is a partial-thickness loss of skin with exposed dermis. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Stage III

Stage III pressure injuries are characterized by full-thickness skin loss where the adipose, granulation, and deeper tissues are visible and may have a presence of slough or eschar (Figure 8.4). The depth of this tissue damage will vary depending on its location on the body and amount of adipose tissue present. The ulcer presents as a deep crater with or without tunneling and undermining; however, fascia, tendon, ligament, muscle, cartilage, and bone are not exposed at this stage an **epibole** (i.e., rolled or curled-under wound edges that slow or stop the wound-healing process) may occur at this stage.

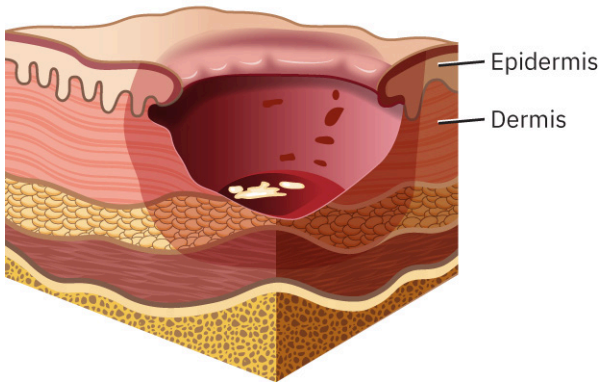


FIGURE 8.4 A stage III pressure injury has necrotic tissue and epibole. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Stage IV

Stage IV pressure injuries show full-thickness skin loss with extensive destruction, necrosis, and exposed or palpable fascia, tendon, ligament, muscle, cartilage, and bone (Figure 8.5). Slough and eschar are often visible along with epibole, undermining, and/or tunneling. The depth of this tissue damage will vary depending on its location on the body and the amount of adipose tissue.

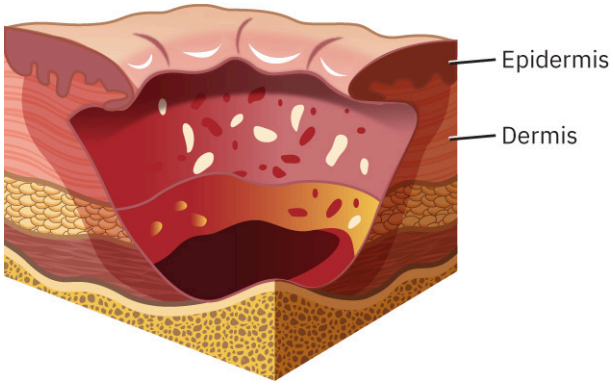


FIGURE 8.5 A stage IV pressure injury extends to the bone, with necrotic tissue and epibole. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Deep Tissue or Unstageable Pressure Injuries

Deep-tissue pressure injuries are classified as persistent, nonblanchable areas of the skin that have maroon, deep red, or purple discoloration (Figure 8.6). The affected areas of the skin may be intact or nonintact. There is a break in the epidermis that reveals a dark wound bed or blood-filled blister. With this type of injury, changes in the color of the skin are preceded by pain and temperature changes. Skin discoloration may appear differently in individuals with darker skin. For example, a bruise that may appear bluish in a patient with light-toned skin may appear black in a patient with darker skin. Deep tissue injuries are often the results of prolonged or intense pressure and shear forces at the bone-muscle interface. This wound may resolve without tissue loss or progress rapidly to expose the magnitude of tissue injury. Deep-tissue pressure injuries should not be used to describe traumatic, neuropathic, dermatologic, or vascular skin conditions.

Pressure injuries are classified as unstageable if they have full-thickness skin or tissue loss and have excessive slough or eschar that obscures the extent of the damage. If slough or eschar is removed, a stage III or IV ulcer may be revealed. Stable eschar on the ischemic limb or heels should not be removed or softened. **Stable eschar** is adherent, dry, and intact without **fluctuance** (tense area of skin with a wave-like or boggy feeling upon palpation) and erythema.

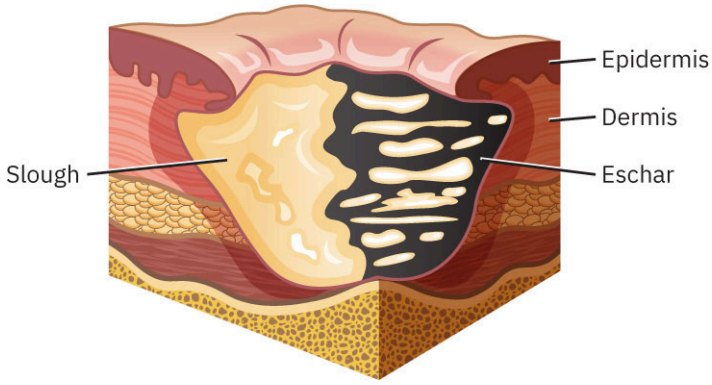


FIGURE 8.6 The presence of both eschar and slough occludes the true depth of the injury and causes it to be unstageable. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

8.2 Wound Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the clinical guidelines used for wound assessment
- Recognize the different tools available for wound assessment
- Identify important aspects of nursing documentation of the wound assessment

Clinical Guidelines for Wound Assessment

Wound treatment varies widely depending on the type, location, age, and appearance of the wound, as well as the characteristics of the patient, type of wound care specialist, and setting of the patient care. Thus, prior to planning for treatment of any wound, initial, thorough wound assessment must take place. The nurse must also consider that wound treatment is also affected by the needs and abilities of the patient as well as family support for ongoing wound care. Consider the wound pictures in Figure 8.7. Each image shows a different type of wound and each type requires different treatment and management strategies on the part of healthcare providers. However, before treatment can begin, assessment must occur.

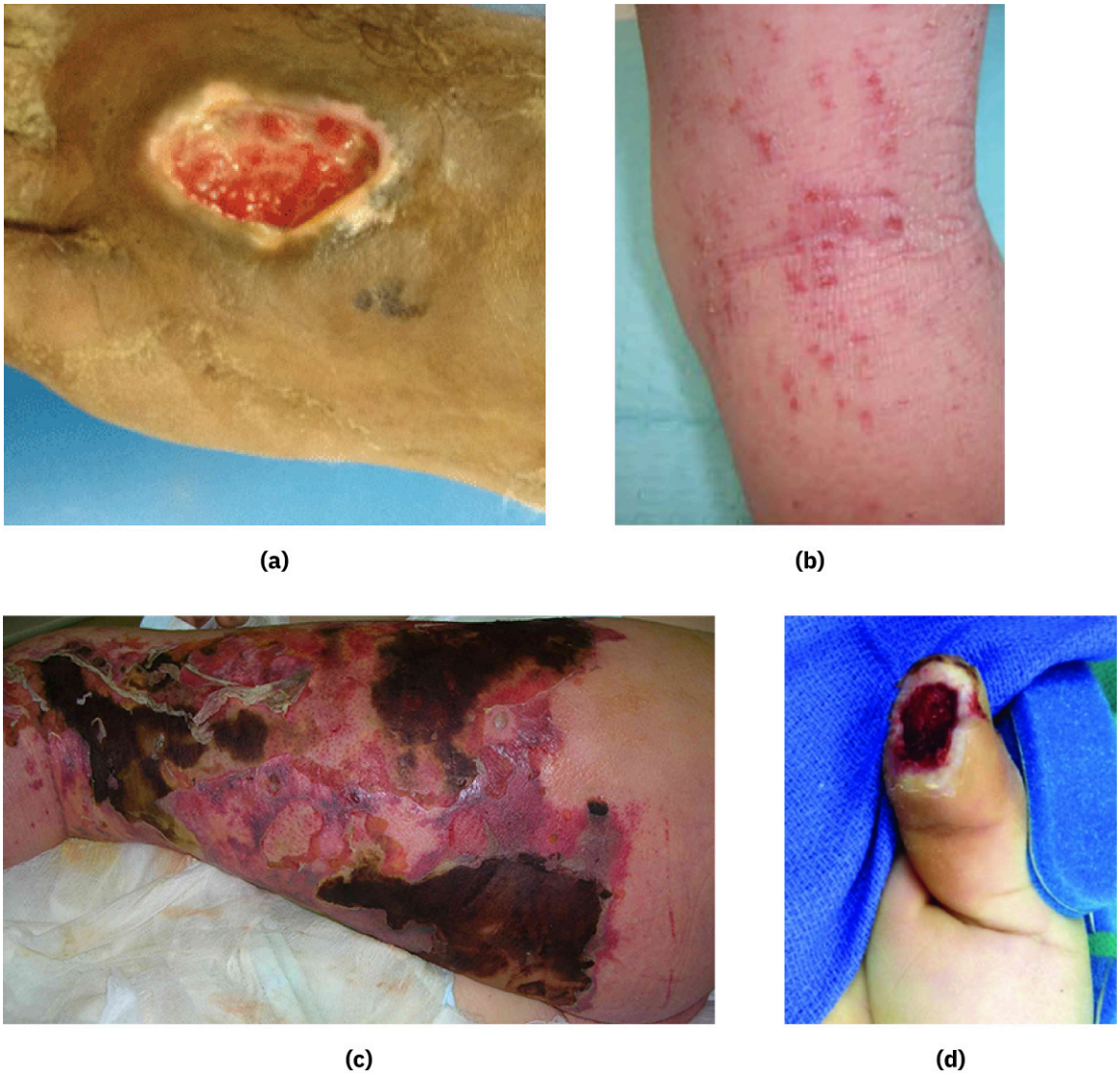


FIGURE 8.7 These images are examples of four different types of wounds: (a) a venous insufficiency ulcer, (b) excoriation, (c) infection from necrotizing fasciitis, and (d) a traumatic injury. (credit: (a) modification of "Venous insufficiency ulcer, by SciforSchenOnline, CC BY 4.0. (b) modification of "Clinical features of atopic dermatitis in English", by Elaine C. Siegfried, Adelaide A. Hebert/Wikimedia Commons, CC BY 4.0. (c) modification of work by Piotr Smuszkiewicz, Iwona Trojanowska, and Hanna Tomczak, CC BY 4.0. (d) modification of "Great Toe-to-Thumb Hemi-Pulp Transfer" by National Library of Medicine, CC BY 2.0)

Type of Wound

Determining how the wound was created helps to determine the type of wound (Nagle et al., 2023). In some cases, the type may be very clear. For example, in Figure 8.7, image (d) is clearly a traumatic wound of some type. The patient can easily state to providers how it occurred (a table saw) and providers know how to manage it appropriately. However, other wounds may be more difficult to manage. Images (a) and (c) both show wounds that require additional investigation before the type can actually be assessed. Image (a) shows an ulcer of some type and image (c) shows a skin infection, but without additional assessment, the exact type of ulcer or infection remains unknown.

Wound Location

Wound locations dramatically impact the strategies providers can use in wound treatment (Nagle et al., 2023). Wounds on skin surfaces that are difficult to keep clean and/or dry, such as skin folds, the perineal area, hands, feet, and/or face, will be managed differently than those that are easier to keep clean and dry, such as the abdomen or arm. Other location concerns include the amount of weight-bearing performed at or near the wound's location. Wound healing requires oxygenation of the surrounding tissue, and areas that bear consistent weight, such as bony prominences such as the coccyx, may heal more slowly or require alternative strategies. Other locations, such as

being near major arteries or vessels, may impact the types of interventions that can be utilized (Nagle et al., 2023).

Visual inspection should include inspecting the wound and surrounding area. Note any visible landmarks or anatomical structures that can help accurately describe the wound location. Use adequate lighting to enhance visibility. Identify nearby anatomical landmarks to describe the wound's location accurately. These landmarks may include bones, joints, muscles, and other structures. For example, a wound could be described as "located on the anterior aspect of the lower leg, approximately 2 in (5 cm) above the medial malleolus." Use of a clock face or grid system is also recommended. If applicable, use a clock face analogy or a grid system to precisely pinpoint the wound location. For instance, you might describe a wound as "located at the two-o'clock position on the dorsal aspect of the right foot" or "in the upper left quadrant of the abdomen."

Wound Characteristics

There are a variety of wound characteristics that also impact diagnosis and treatment interventions (Table 8.4). Each of these must be assessed and documented as part of the initial treatment process.

Characteristic	Examples	Importance
Appearance	Color, depth, surrounding skin, shape, presence of foreign bodies, and exposed muscle or bone	• The appearance of a wound helps providers determine the type of wound. • Surrounding skin assists in determining the health of the tissue. • The base of the wound should be healthy, pink/red granulation.
Measurement	Circumference, depth, length, and width	• Wounds are measured to monitor healing and determine the extent of the damage to underlying anatomical structures. • Length is measured using the head-to-toe axis, and width is measured laterally. • If tunneling or undermining is present, their depth should be assessed using a sterile, cotton-tipped applicator and documented using the clock-face method. • Provide figures with measuring tape to demonstrate how this is done. • Use a sterile cotton swab for measurement versus nonsterile measuring devices, then lay the cotton swab on top of the measuring tape.

TABLE 8.4 Wound Characteristics and Assessment Importance (Source: Nagle et al., 2023; Bishop, 2021.)

Characteristic	Examples	Importance
Edges	Smooth, jagged, rounded edges, presence of **undermining** (erosion beneath skin surface beyond visible edges) or **tunneling** (erosion in channels beneath intact skin surrounding a wound) should be noted. Approximated (clean edges, that close easily) versus not approximated (jagged edges) should be documented.	• Different types of wounds have different types of edges. • Rounded edges, undermining, and tunneling may all indicate that the wound extends under the skin farther than the eye can see, thus impacting more anatomical structures.
Exudate (liquid that secretes from the wound)	**Purulent** (pus, tan to yellow), **foul purulent** (purulent with foul odor), **serous** (thin, watery, clear), **serosanguineous** (mix of serous fluid and blood), **sanguineous** (bloody)	• The type of exudate indicates the health of the underlying tissues.

TABLE 8.4 Wound Characteristics and Assessment Importance (Source: Nagle et al., 2023; Bishop, 2021.)

Skin Tone

Skin tone is another critical piece of wound assessment. Identifying a baseline skin tone enables changes to be identified quickly. Also, different skin tones reflect wounds and injuries in different ways. Consider **erythema**, a change in skin color due to a change in blood flow. Traditionally, erythema has been described by "redness." However, erythema generally only appears red for individuals with pale skin tones (Dhoonmoon et al., 2023). For patients with darker skin tones, erythema may also be pink or purple, or simply a darkening of the surrounding skin. Thus, particularly for patients with darker skin tones, textural or temperature-based skin changes may be more important than appearance (Dhoonmoon et al., 2023).

Wound Assessment Tools

Wounds may include intentional wounds such as surgical sites that are prone to infection and complicated wounds such as pressure injuries, traumatic injuries, and various types of venous ulcers. There is a variety of wound assessment tools used to confirm the risk of developing wounds or to monitor healing. Different strategies can be employed depending on the risks various patients experience. For wounds that are more difficult to heal, providers must have reliable assessment methods to ensure appropriate and accurate communication among team members and allow for accurate assessment of changes between visits (Bates-Jensen et al., 2019).

Braden Scale

The **Braden Scale** is the most used pressure injury risk assessment tool in the United States and is used across many healthcare settings, including critical and acute care, long-term care, rehabilitation, and even by home-based nursing (Kennerly et al., 2022). It evaluates the relative risk of a patient developing skin breakdown and pressure injuries. The scores can be used to tailor pressure injury prevention interventions to patients at risk of injuries (Kennerly et al., 2022).

The Braden Scale uses six subscales: mobility, activity, sensory perception, nutrition, friction/shear, moisture (Kennerly et al., 2022). Each of these six factors is scored on a scale from 1 to 4, depending on the factor. After each item is decided, the ratings are added together for a possible score between 6 and 23. The lower the score, the greater the risk for development of a pressure injury. All patients scoring 18 and below should be reassessed regularly, on a schedule dictated by facility and healthcare setting. Patients scoring above 18 should be reassessed when they experience condition-related changes.

LINK TO LEARNING

The Braden Scale (https://openstax.org/r/77bradenscale) is a very helpful tool to establish the relative risk of a patient experiencing issues with skin breakdown.

The Braden Scale is a tool used by nurses to identify a patient's risk of developing pressure injuries and is typically completed on admission to a hospital or other healthcare facility (Table 8.5). This evidence-based assessment tool rates the patient on a scale of 1 (completely limited) to 4 (no impairment) in the following categories: sensory perception, moisture, activity, mobility, nutrition, and friction and shear. The ranges for the scores are mild risk (15–18), moderate risk (13–14), high risk (10–12), and severe risk (9 or less).

Category	1 (most severe)	2	3	4
Sensory perception	Completely limited, unresponsive	Very limited, only responds to painful stimuli	Responds to verbal commands but limited communication	No impairment, responds and communicates
Moisture	Constant moisture	Frequent moisture/ linen changes	Occasional moisture/extra linen change	Usually dry/routine linen change
Activity	Bedbound	Chairbound, limited walking	Short-distance walking	Frequent walking
Mobility	Immobile	Very limited	Slight limitations	No limitations
Nutrition	Very poor	Likely inadequate	Adequate	Excellent
Friction, shear	Constant friction, requires assistance	Movement with minimal assistance	Independent movement	N/a

TABLE 8.5 The Braden Scale

Simplified Surgical Site Event Risk Assessment (SSERA) Model

Despite the use of best practices in surgeries, there remains a risk for surgical site infections (SSIs) for everyone undergoing major surgery. In the United States alone, there is are estimated 200,000 SSIs annually, with a cost of up to $10 billion a year (SSERA Group, 2023). The simplified **Surgical Site Event Risk Assessment (SSERA) model** uses six risk factors to individually evaluate a patient's risk for an SSI and each risk factor is assigned a color (green, orange, or red) based on the relative risk for an SSI.

LINK TO LEARNING

You can view the Surgical Site Event Risk Assessment (SSERA) model (https://openstax.org/r/77ssera) in Figure 1 of this publication. The SEERA model helps surgeons determine an individual patient's risk for surgical site infection, based on six risk factors.

A patient's risk for SSI is evaluated based on the data in the table. If a patient is positive for any red box or three orange boxes, they are considered a high risk for SSI. Any two orange boxes make them an elevated risk for SSI (SSERA Group, 2023). Once a patient's risk for SSI is known, additional protections can be used (where possible) to monitor for and prevent SSIs.

Wagner Ulcer Classification System

In patients with diabetes, foot infections are common, due to peripheral neuropathy (loss of feeling in the extremities that keeps patients from recognizing they have a wound) and may result in amputations (Bhowmik, 2023). Long-term glucose changes related to diabetes affects circulation and blood vessels, increasing the healing time for wounds and the risk of infection and gangrene (Shah et al., 2022). The **Wagner Ulcer Classification System** is one of many types of assessment tools used for patients with diabetic foot ulcers.

The Wagner system is used to determine the severity of a diabetic ulcer by looking at depth, amount of **tissue necrosis** (tissue death), and presence of **osteomyelitis** (bone infection) (Bhowmik, 2023). It classifies diabetic foot ulcers into grades between 0 and 5 (Table 8.6) (Song et al., 2022; Shah et al., 2022).

Wagner Grade	Description
0	Intact skin that may have bunions, claw toes, or Charcot breakdown. There may also be hyperkeratotic lesions near bony deformities, indicating the foot is at risk of breakdown.
1	Superficial ulcer with no penetration to deep layers. The base of the ulcer may be necrotic or granulating (tissue regrowth).
2	Deeper lesion extending to bone, ligament, tendon, or deep fascia. There is no abscess or osteomyelitis at this stage.
3	Deep abscess, osteomyelitis, or infection of tendon. This stage often requires imaging, probing to the bone, and/or bone biopsy to assess the extent.
4	Some portion of the forefoot or toes is gangrenous. Gangrene may be classified as wet or dry.
5	Severe gangrene with no potential for healing, necessitating the amputation of all of the gangrenous area.

TABLE 8.6 The Wagner System

LINK TO LEARNING

Sometimes the best way to understand wound classifications is to see examples. You can see images of the Wagner staging and learn more about the Wagner classification system (https://openstax.org/r/77wagner) in this helpful reference guide. Please be prepared; some of the images are very graphic.

Bates-Jensen Wound Assessment Tool (BWAT)

The **Bates-Jensen Wound Assessment Tool (BWAT)** is used to evaluate wound status and healing; it measures thirteen wound characteristics. The BWAT was initially developed to be used with pressure injuries; however, it has been widely used with a variety of wounds including post-surgical, infected, and various ulcerative wounds (Bates-Jensen et al., 2019). The BWAT (Table 8.7) is a good assessment tool because it can be used by individuals with limited wound care experience; however, it is slightly less accurate when used on patients with darker skin tones.

Item	Assessment
Size	Use a ruler to measure length and width and then multiply to get the area.
Depth	Choose the appropriate depth ranging from intact, nonblanchable skin to underlying structural damage, such as damage to tendons and bone.

TABLE 8.7 Bates-Jensen Wound Assessment Tool (BWAT)

Item	Assessment
Edges	Describe edges from indistinct, attached but flat and flush with wound base, not attached (base of wound is deeper than the edge), thickened or rolled under, callous-like, or fibrotic (hard, and rigid to the touch).
Undermining	Assess by using a cotton applicator under the wound edge and advance as far as possible without adding pressure. Measure the distance between the edge and end of cotton applicator. Continue around the wound to look for undermining at all points.
Necrotic tissue	Choose the predominant type of necrotic tissue according to color, consistency, and attachment to wound: white/grey nonviable tissue, yellow slough that does not adhere to the wound but lifts out easily, yellow slough that is loosely attached to wound, boggy black eschar attached to wound bed, or firm crusty hard/black eschar tissue attached to base and edges.
Necrotic tissue amount	Use a transparent measuring guide to determine the percentage of necrotic involvement.
Exudate type	Cleanse wound with normal saline or water before assessing due to the way some dressings work. Choose the most predominant from bloody, serosanguineous, serous, purulent, and foul purulent (thick yellow to green with odor).
Exudate amount	Determine the amount of exudate based on wound bed and used patient's dressing; range from none to large (> 75 percent of dressing saturated or wound bathed in fluids).
Skin color of surrounding wound	Assess tissues within 1.6 in (4 cm) of edges. People with darker skin will show deepening of normal skin color or purple. When healing, their new skin may be pink and may not darken.
Peripheral tissue edema	Assess tissue within 1.6 in (4 cm) of wound edges. Observe for skin that is puffy, shiny, and tight. Press fingertip into intact tissue for five seconds and observe for indentation. Measure how far edema expands from wound edge.
Peripheral issue induration	Assess tissue within 1.6 in (4 cm) of wound edges. Observe for areas of abnormal firmness with clear boundaries (such as bumps under the skin). Measure size and distance from wound edge.
Granulation tissue	Early tissue regrowth: Health granulation is bright, beefy red, and shiny. Poor circulation appears pale pink or blanched to a dull color.
Epithelialization	Skin regrowth: Young skin is usually pink or red; may be in base of wound or only growing in from the edges. Measure percentage with a transparent measurement tape.

TABLE 8.7 **Bates-Jensen Wound Assessment Tool (BWAT)**

PATIENT CONVERSATIONS

Using the BWAT

Scenario: In this clinical narrative, a wound care nurse answers a patient's questions about using the BWAT.

Nurse: Hi, Mr. Johnson. How are you feeling today?

Patient: Oh, not too bad, I guess.

Nurse: Can I take a look at your wound?

Patient: Well, you can, but I don't know why you'd want to! Gives me the heebie-jeebies.

Nurse: I can understand if you're feeling a little squeamish, but it's important that we keep an eye on it and make sure it's healing. Let me go ahead and put on my gloves, and we'll see how it's doing, okay?

Patient: Sure.

[After putting on sterile gloves, the nurse starts to gently uncover the patient's wound.]

Nurse: Okay, let's have a look.

Patient: What are you looking for, anyway? [chuckles] Bugs?

Nurse: Not exactly! When I check your wound, I'm looking for signs that it's not healing well or is infected. So, I want to see if your skin is red and swollen, if there's any pus or blood coming out.

Patient: It isn't bleeding anymore, but sometimes the bandage feels a little damp.

Nurse: That's good to know! Paying attention to how your wound looks and feels is very helpful for me. It can be normal for there to be some fluid coming out of the wound as it heals, but we still want to see how much there is and what it looks like. Even what it smells like!

Patient: I think that's a little too much for me! I'll let you do a sniff test.

Nurse: Fortunately, I think your wound is in pretty good shape. See how the edges are starting to come together? That's a sign that your skin is doing its job to heal and close up the wound. I don't see any signs of an infection, which is great. How's your pain?

Patient: Not as bad as it was, but it still twinges sometimes.

Nurse: That can be a normal part of the healing process—but tell me if it starts to hurt more or you think the discomfort is getting worse.

Patient: Okay.

Nurse: Before we get a new dressing on there, do you mind if I snap a picture?

Patient: Ha! For your personal collection?

Nurse: No, photos are kept in your file for medical purposes only. Remember last time I took a photo for your record? I'll compare the one I take today to that one to get a better idea of how your healing is progressing. I can't remember every detail of all the wounds I treat, so having pictures is very helpful.

Scenario follow-up: In this example, the nurse has efficiently performed a wound check on a patient while also answering his questions about the importance of tracking progress.

Nursing Documentation of Wound Assessment

When documenting wound assessments, nurses must be careful to document accurately and without assumption. Incorrect documentation may negatively impact patients as clinicians reviewing the documents will be unable to accurately evaluate the severity of the wound and information about the healing process. Documentation is also important for regulatory agencies such as departments of health, third-party payers such as private insurance and the Centers for Medicare & Medicaid Services, accreditation bodies such as the Joint Commission and the Long-Term Care Institute, and even for potential legal proceedings (WoundSource, 2022). Ensure the following information is included in wound documentation (Song et al., 2022; WoundSource, 2022):

- type of wound or cause, such as pressure injury, surgical site, traumatic wound
- any related healthcare conditions such as diabetes, neuropathy, or gangrene
- location information including anatomical body part and information, such as right/left, front/back, top/bottom, midway between

- wound size: length, width, depth in centimeters
- **wound thickness**: amount of skin breakdown, fat exposure, and bone and/or muscle involvement
- any indication of infection, such as fever, increased drainage, odor, heat, swelling, or pain
- patient variables including refusal to participate in care or adhere to treatment plans
- photographic evidence of the wound (both for legal reasons and to monitor wound-healing progress

Correct Terminology

When documenting a wound, always use the correct terminology and location information (Table 8.8).

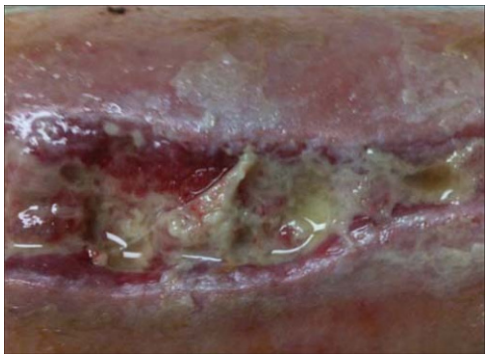
Description Type	Terms
Wound bed characteristics	Granulation: healing state in which new tissue begins to form (credit: "Granulation tissue" by John Campbell/Flickr, Public Domain)
	Slough: wet yellow to white tissue in wound bed made of dead cells; may or may not be attached to wound bed  (credit: "Biofilm delays wound healing" by National Library of Medicine, CC BY 4.0)

TABLE 8.8 Wound Terminology (Source: WoundSource, 2022.)

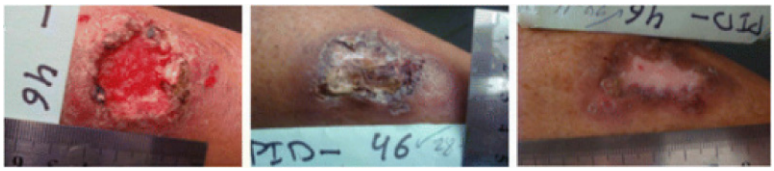
Description Type	Terms
	Eschar: dead tissue formed over healthy skin (credit: modification of “pntd.0005020.g003”, by National Library of Medicine, Public Domain)
	Epithelialization: growth of **epidermis** (skin cells) over skin and wound surface; healing to close wound  (credit: modification of “Photo-documentation of wound epithelialization of crusted lesions after removal of the crusts” by National Library of Medicine, CC BY 4.0)
Wound edges	Defined versus undefined: how clear are the boundaries of the wound from the surrounding skin?
	Attached versus unattached: are the edges of the wound attached to the underlying tissue or can a cotton swab or instrument slide between the layers?
	Approximated versus not approximated: are wound edges brought together and aligned in a close or near-close manner or are do they remain separated or open?
	Epibole
	Maceration
	Callused or fibrotic edge (toughened skin around wound edges)
	Wound margin (edges of wound)
Skin beyond the wound	Color
	Temperature

TABLE 8.8 **Wound Terminology** (Source: WoundSource, 2022.)

Description Type	Terms
	Edema (swelling): present or absent
	Boggy (spongy)
	Induration (thickened or hardened area): provide a location and size (credit: modification of "Initial clinical appearance of right nipple" by National Library of Medicine, CC BY 4.0)
	Undermining, tunneling, or sinus tracts (cavity leading from an abscess beneath the wound to the surface)
Exudate type	Serous
	Sanguineous
	Serosanguineous
	Purulent
	Foul purulent
Exudate amount	Scant: wound tissue moist, no drainage on dressings
	Minimal: tissue moist, light exudate on dressing
	Moderate: tissue wet, up to 75 percent of dressing saturated over twenty-four hours
	Large: wound filled with fluid; > 75 percent of dressing saturated

TABLE 8.8 **Wound Terminology** (Source: WoundSource, 2022.)

LINK TO LEARNING

Restorix Health and American Medical Technologies published a document to help study and learn appropriate documentation of wounds (https://openstax.org/r/77restorix) in patients.

Recommendation for Reevaluation

Most wounds progress normally through the four stages of healing: hemostasis, inflammatory, proliferation, and maturation. They should be reevaluated throughout the healing process to ensure they are healing effectively and appropriately. This process is described further in 8.3 Wound Management. When issues occur at any stage,

additional steps may be required to ensure wound healing.

8.3 Wound Management

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Examine the phases involved in wound healing
- Identify circumstances that can affect wound healing
- Identify the psychological effects wounds can have on the patient
- Recognize complications affecting wound healing
- Explain the role of nursing interventions in wound care management

Wound management encompasses many nursing interventions that are essential for promoting healing and regeneration of tissues. Different techniques are used to treat wounds, such as applying dressings or leaving the wound open to air. The technique or intervention used is dependent on the type of wound present. To effectively manage wounds, nurses must understand the phases of wound healing, factors affecting wound healing, psychological effects of wounds, complications affecting wound healing, and the nurse's role in wound care management.

There are three types of wound healing: primary, secondary, and tertiary intention healing. **Primary intention healing** occurs when the wound edges have been approximated with little to no tissue loss and show formation of nominal granulation tissue and scarring. For example, a surgical incision closed after surgery using sutures or a liquid adhesive is primary intention healing. These wounds are easily closed in a line formation. Secondary intention healing is for extensive wounds that have significant tissue loss, making approximating edges difficult or not a good option. Pressure injuries are examples of **secondary intention healing**. Secondary intention healing takes longer, has more scarring, and is more susceptible to infection. **Tertiary intention healing** (i.e., delayed primary intention) occurs in wounds that are intentionally left open for three to five days to allow edema or infection to resolve or to let any exudate to drain. After that period of time, the wounds are closed with sutures, adhesive closures, or staples.

Phases of Wound Healing

Wound healing can be broken down into the following phases: hemostasis, inflammatory phase, proliferation phase, and maturation phase (Figure 8.8). There are three phases of wound healing: inflammatory, proliferation, and maturation; in this case, hemostasis is included as part of the inflammatory phase. After an injury, the body automatically undergoes these phases, which methodically lead to tissue repair.

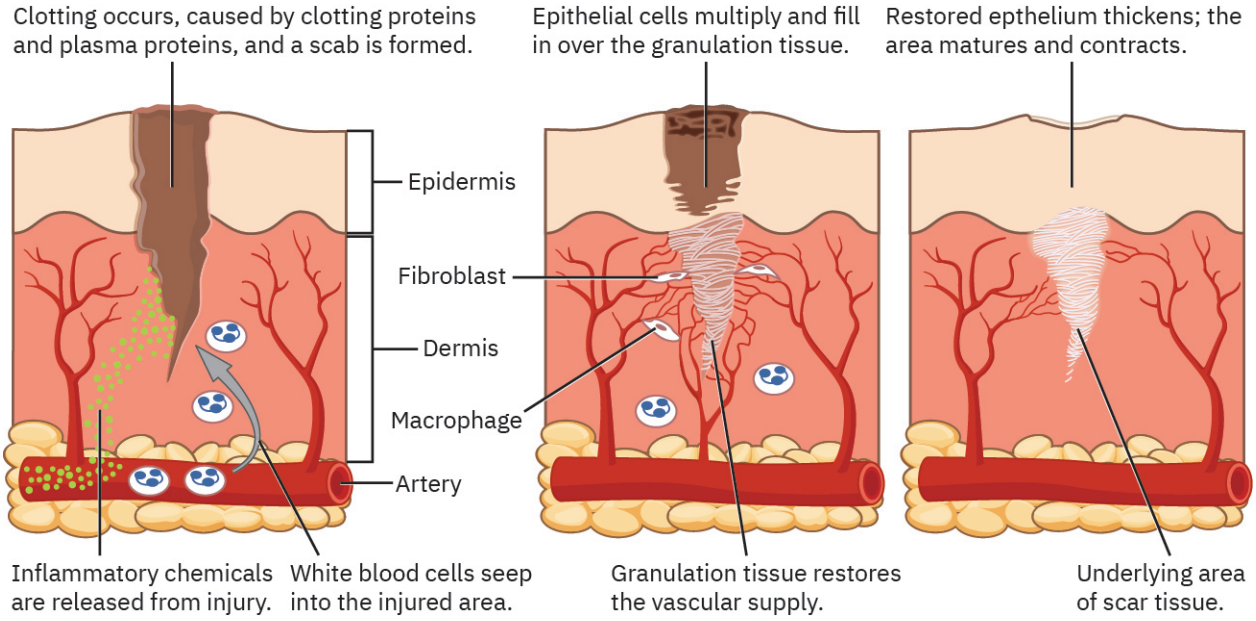


FIGURE 8.8 The phases of wound healing are inflammatory, proliferation, and maturation. This process begins immediately after an injury and varies in length. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Hemostasis

Immediately after an injury, **hemostasis** (i.e., cessation of bleeding) occurs through vasoconstriction of blood vessels in the area, deposition of fibrin, and formation of blood clots through blood platelets. The blood clots provide a matrix of fibrin that becomes the framework for cell repair. After vasoconstriction, exudate is formed when the blood vessels expand, increasing capillary permeability, which allows plasma and blood components to leak out into the injured area. Pain and swelling may occur as a result of the buildup of exudate. Heat and erythema are the outcome of increased perfusion. Scabs form on the wound surface to protect the injury when blood clots lose their fluid. Epithelial cells migrate under the scab to provide a barrier between the body and the environment and to prevent the entrance of microorganisms.

Inflammatory Phase

Following hemostasis, the inflammatory phase begins and lasts about two to three days. During this phase **phagocytosis** occurs when leukocytes and macrophages move into the interstitial space to ingest bacteria and cellular debris. The macrophages also release angiogenesis factor that stimulates the formation of epithelial buds at the ends of injured blood vessels. The growth factor attracts fibroblasts that help fill in the wound. This phase may be depicted by pain, redness, heat, and swelling at the injury site. The patient may have a general body response such as a slightly elevated temperature, elevated number of white blood cells, and general discomfort.

Proliferation Phase

The proliferation phase is also known as the reconstructive, fibroblastic, regenerative, or connective tissue phase. This phase begins around day three or four and may last up to several weeks. Fibroblasts that migrated to the wound begin to synthesize **collagen**, a whitish protein substance that adds flexible strength to the wound. Collagen synthesis peaks in five to seven days, although the collagen deposits may persist for several weeks or years depending on the size of the wound. The fibroblasts also produce specialized growth factors that prompt blood vessel formation and proliferate the amount and migration of endothelial cells. Capillaries grow across the wound, increasing the blood supply and oxygen needed through a process called **angiogenesis**.

Fibroblasts move from the bloodstream into the wound to deposit fibrin. As the capillary network develops, the tissue becomes translucent red, a granulation tissue that is delicate and bleeds easily. This granulation tissue provides the framework for scar tissue development. Wounds that heal by first intention have epidermal cells that seal the wound within twenty-four to forty-eight hours, and granulation tissue would not be evident. Wounds that were not sutured need the injury site to be filled in with granulation tissue. After maturation of the granulation tissue, marginal epithelial cells migrate to the site, proliferating over this connective tissue base to fill in the wound.

By the end of the second week after the injury, the majority of white blood cells have left the wound area, making the wound lighter in appearance. The generalized symptoms the patient had generally disappear by this point. Adequate nutrition and oxygenation are essential patient care considerations for this phase. Any wound closed with sutures or other type of closures should be prevented from experiencing any type of strain, such as the patient lifting something heavy or pulling the patient in a way that adversely affects the injury site.

Maturation Phase

The maturation phase is the final phase of wound healing and begins around day twenty-one; it can last up to months or years. Fibroblasts continue to synthesize collagen during this phase. The collagen fibers are reorganized into an orderly structure in this phase and promote a stronger wound. The collagen also aids in making the wound more like its neighboring tissues. When new collagen continues to synthesize, the blood vessels in the healing wound compress so that the scar does not sweat, tan in sunlight, or grow hair. The scar becomes a flat, narrow line and is not as elastic as uninjured tissue. The scar becomes stronger, but the tissue in the repaired area is never as strong as original tissue. Wounds healed by secondary intention may take longer to remodel and form a scar. When scars form over a joint or adhere to body structures, **arthrofibrosis** occurs which may limit mobility or cause a disability. For example, arthrofibrosis occurs when scar tissue forms around the knee joint after knee surgery, which limits the range of motion.

Circumstances Affecting Wound Healing

There are several factors that influence the speed of wound healing. Localized factors are those factors that occur directly in the wound or directly influence the wound's characteristics. On the other hand, systemic factors occur

throughout the body due to a disease state or overall health of the individual and their body's ability to promote healing. Some factors may be related, and systemic factors act through the local effects that can impact wound healing (Monika et al., 2022).

Localized Factors

A **localized wound healing factor** (e.g., desiccation, maceration, trauma, pressure, excessive bleeding and edema, or infection) directly affects the wound and may delay the process of healing. Meticulous care is necessary with wound management to prevent or limit these factors that can impede wound healing. It is important for nurses to understand these factors to promote optimal outcomes, improve wound care, improve the patient's quality of life, and prevent significant healthcare costs.

Desiccation

The unintentional wound or tissue dehydration, or desication, occurs when cells do not get adequate moisture, so they dry up and die. This cell death leads to a crust that forms over the wound site, which impedes healing. This can occur naturally as part of the wound-healing process or as a result of external factors such as exposure to air, inadequate wound dressing, or excessive use of wound irrigation solutions. While a certain level of desiccation is normal and may promote wound healing by facilitating the formation of a protective scab, excessive desiccation can impede the healing process. Prolonged drying of the wound bed can lead to tissue dehydration, delayed epithelialization, and increased risk of infection. Additionally, desiccation can cause discomfort and pain for the patient as well as impair the migration of cells involved in wound repair.

Maceration

Just as a wound can get too little moisture, there can also be an excess of moisture. Maceration is softening and breakdown of the skin due to overhydration. A common cause of maceration is urinary and fecal incontinence. This type of moisture also causes changes in the pH level of the skin, destroys skin from friction on moist skin, and causes overgrowth of bacteria or infection of the skin that in combination leads to maceration and impaired skin integrity.

Trauma

Any kind of **trauma** to the wound area can impede healing partially or completely. Trauma, like a blow or blunt force, can impede blood flow or lead to edema in the area. The trauma can also cause further damage to the skin or underlying tissues and reinitiate the inflammatory process.

Pressure

Pressure can adversely affect timely wound healing. Excessive or persistent pressure can disrupt the blood flow to the injured tissues and delay wound healing because the wound needs nutrients from the blood supply. This happens when a patient is lying or sitting in the same position for a prolonged period of time.

Bleeding and Edema

Excessive bleeding can also adversely affect wound healing because it may lead to large clots, which interfere with tissue perfusion. An accumulation of blood or any type of drainage becomes a breeding ground for bacterial growth and infection. Edema disrupts the blood flow to the wound, which decreases the supply of oxygen and nutrients that encourage the biological processes that take place during the phases of wound healing. The swelling can also cause pain at the wound site and potentially limit the patient's mobility. This further leads to a lack of necessary circulation.

Infection

Infection is often caused by bacteria or other microorganisms in the wound. Infection puts a strain on the affected person's body because of the increased demand for energy by the immune system to combat microorganisms. This strain leaves little or no energy for the body to promote the process of repair and healing. Bacteria also produce toxins and release them when they die, which further affects wound healing and leads to cell death.

Systemic Factors

A **systemic wound healing factor** is one not related to the wound itself. These factors take place throughout the body and include age, venous insufficiency, poor oxygenation, obesity, diabetes, medications, and smoking or alcohol use. In addition, wound etiology directly affects the process of wound healing. Wounds that are the result of a systemic issue, such as a venous ulcer, may recur. Nutritional status plays a significant role in wound healing as

adequate carbohydrates, proteins, fats, minerals, fluids, and vitamins are needed to rebuild cells and tissues, promote epithelialization and collagen synthesis, and support optimal cell function. Patient adherence to the treatment plan is also a crucial element of wound healing. Patients who are noncompliant can experience negative effects on wound healing. Protein supplements may be necessary to meet wound-healing needs in patients who are unable to adequately take in the necessary proper nutrition.

Age

Skin changes are a normal part of aging. However, these changes can adversely affect wound healing in an older adult. Vascular changes (e.g., atherosclerosis or capillary atrophy) can impede blood flow. Collagen is less elastic, which increases the risk of injury or damage by pressure, friction, and shearing. Immune system changes can decrease antibody and monocyte formation, which is needed for wound-healing processes to occur. Older adults may also be deficient in necessary nutrients and fluids or have chronic conditions that impair oxygen delivery to wounds (e.g., chronic lung disease). Cell renewal is slower in older adults and results in prolonged healing.

Infants and small children with wounds are noted to have impaired skin integrity. The epidermis and dermis are not well adhered to one another in this age group. This loose binding may lead to easily separated layers during the inflammatory process. The unintentional removal of the epidermis when removing tape is a type of epidermal stripping.

Venous Insufficiency

Venous ulcers caused by an increase in pressure and buildup of fluid in the lower legs is usually caused by venous insufficiency. This generally is the result of high blood pressure, long periods of sitting or standing, lack of exercise, smoking, deep venous thrombosis, obesity, tissue trauma, and phlebitis. This combination leads to cell death, tissue damage, or wounds because of a lack of nutrients and oxygen. Blood flow is needed to not only deliver nutrients and oxygen but also remove bacteria, toxins, and other debris. Therefore, wounds caused by venous insufficiency or another source are at risk of delayed wound healing.

Poor Oxygenation

Oxygen is essential for the biological processes, such as angiogenesis and collagen synthesis, that take place within the phases of wound healing. Poor oxygenation may be due to systemic factors such as diabetes or advanced age. It may also result from any factors that impair vascular flow to the tissues. A lack of oxygen prolongs healing and can lead to cell death. Oxygen also has antimicrobial effects and plays a vital role in the inflammatory response. People with poor oxygenation are more susceptible to infection, which further complicates wound healing.

Obesity

Obesity is defined as having a body mass index equal to or greater than 30 (National Institutes of Health, 2022). Individuals who have obesity are often protein deficient, which delays wound healing. Proteins provide the main building blocks for cell renewal and tissue growth. Obesity also increases risks of wound infection and delayed healing due to the minimal blood supply in adipose tissue. Large amounts of adipose tissue where wounds are present are also more difficult to suture.

Diabetes

Diabetes negatively affects wounds. Diabetes impairs circulation needed to deliver oxygen and nutrients. Uncontrolled blood sugar levels can damage the nerves and cause numbing sensations known as **diabetic neuropathy**. This reduced sensation means that the affected person may not be aware of the wound, resulting in the lack of or delayed intervention. Uncontrolled blood sugar levels also impair white blood cell function needed to fight bacteria and close wounds in the inflammatory response.

Medication

Some medications may have an adverse effect on wound healing. Steroids affect the inflammatory phase and decrease its response. Radiation results in decreased leukocytes and increases the chance of infection because of depressed bone marrow function. Chemotherapeutic agents may impair or stop the growth of new cells needed for wound healing. Patients who have prolonged antibiotic use are at risk of secondary infection or **superinfection** (e.g., *Clostridium difficile*). This means that the infection is unrelated to the original infection and results from opportunistic colonization following immunosuppression. Medications used to treat skin disorders inadvertently cause thinning of the outermost layer of the skin, increasing susceptibility to breaks in the surface.

Smoking and Alcohol

Smoking inhibits the oxygen-carrying capacity of the blood and constricts arterioles. This reduces the amount of functional hemoglobin in the blood and delays wound healing. Alcohol consumption interferes with the inflammatory and proliferation processes and can make an individual more susceptible to infection. Alcohol can also negatively affect the liver and immune systems, which are crucial for healing.

Psychological Effects of Wounds

Wounds can be debilitating and have a significant effect on a person's self-identity and emotional well-being. The skin plays a role in communicating with other organs in the body through its sensory functions and affects a person's self-image. Patients can suffer from anxiety, post-traumatic stress disorder (PTSD), and depression as a result of how the wound was created—based on it being a traumatic injury, either intentional or nonintentional—and emotions contribute to the patient's overall well-being and outcome. Wounds and pressure injuries cause stress and emotional factors related to pain, fear, disruption to activities of daily living, and an altered body image. These stressors are interconnected and can impact not only the patient but also their caregiver or loved ones.

Pain

Any type of trauma can cause pain no matter the size of the injury. Pain is a physical complication but has a substantial psychological element. Wound pain may be caused by coughing, moving in bed, dressing changes, ambulating, or other activities that require movement. Pain attributed to these activities may result in the patient hesitating or avoiding them altogether. Pain can be debilitating to the affected persons and often lead to depression, further contribute to stress, cause fear and anxiety, and disrupt overall activities of daily living. Pain can also cause altered vital signs such as tachycardia, tachypnea, and elevated blood pressure. Nursing interventions to reduce pain can reduce discomfort and emotional stress. For example, administering pain medication before performing wound care may reduce the amount of pain during the process.

Fear

Fear is a common response to wounds. The pain and disruption to activities of daily living can contribute to anxiety and fear. Patients are often concerned about the wound-healing process and complications that may arise, such as wound dehiscence (partial or complete opening of a wound) and infection. They may also be worried about other people's responses to the wound appearance or smell as well as how much their privacy will be invaded when undergoing wound care. The fear of rejection may lead to social isolation. Nursing interventions should include therapeutic conversation that encourages expression of feelings, answering questions honestly and accurately, exhibiting empathy and acceptance, and preventing excessive exposure of body parts during care.

Disruption to Activities of Daily Living

Wound management can be tedious and time consuming and disrupt a person's routine. The physical, medical, and financial burdens or restrictions can limit a person's ability to perform their activities of daily living. Pain associated with the wound may also affect their independence. Being unable to perform self-care, homemaking, work, leisure, or social activities can have a negative effect on the life of the patient and caregiver.

Altered Body Image

A negative body image can damage a person's self-esteem. The skin is part of what gives someone their identity; therefore, any wound or trauma requires adaptation of the concept of self. This may make a person self-conscious when scars or wounds are visible to others. Scars on the face or ones that take up a large margin of skin may result in diminished self-worth or feelings of ugliness. This type of negative self-image can lead to social isolation, further exacerbating the other stressors associated with wound management. Nursing interventions are similar to that of fear and include therapeutic conversations encouraging expression of feelings, answering questions honestly and accurately, exhibiting empathy and acceptance, and referring patients and their caregivers to support groups or counselors who can aid in coping skills and acceptance.

CLINICAL JUDGMENT MEASUREMENT MODEL

Recognize and Analyze Cues

Before recognizing cues, nurses must make sure they have enough information about a patient's situation before

interpreting the information and developing a plan of care. For example, patients experiencing fear related to their wound may have anxious feelings about wound care, pain, rejection from others, or how the wound will affect their life. The nurse should assess the patient's feelings and gather information about activities of daily living, how much support or help the patient has at home, and any other aspects affecting the patient's self-identity and mental well-being. The nurse should also be aware of nonverbal cues during care (e.g., looking away or grimacing) to assess discomfort or unease.

Wound Complications

There are several events that can interfere with wound healing and may cause complications. Infection, hemorrhage, dehiscence and evisceration, and fistulas can increase the risk of death or generalized illness, increase healthcare costs, and prolong the need for healthcare interventions.

These complications can also exacerbate the emotional stressors associated with wounds.

Infection

Wound infections are common. Wounds are by their nature "dirty" and contain bacteria. However, not all wounds are infected. When the immune system fails to limit microbial growth, wound infection occurs. The invasion of microorganisms can occur at the time of the injury, during surgery or postoperatively, or any time after the injury. People with suppressed immune systems or who are undergoing myelosuppressive cancer treatment are more susceptible to infection. Wounds contaminated at the time of injury (e.g., knife or gun wounds) are more prone to infection than an uncontaminated wound. Surgeries involving the intestines increase the risk of infection because of feces and microorganisms inside the intestines. Most surgical-related infections are apparent two to eleven days postoperatively.

To be considered infected, a wound must include pain, redness, swelling, and purulence (Nagle et al., 2023). Table 8.9 provides signs and symptoms of wound infections that should be routinely monitored (Bishop, 2021).

Sign/Symptom	Examples
Wound bed	Bright red, fragile granulation tissue with pockets
Exudate	Increased exudate; cloudy, yellow, green, pus; smelly; leaking around wound closures
Periwound area	Redness, inflammation, streaks leading out from wound
Swelling	Unusual swelling near the wound and nearby swollen lymph nodes
Fever	Typically seen in combination with other symptoms
Pain	Increasing in intensity, new, or changed from previous pain

TABLE 8.9 Signs and Symptoms of Wound Infections (Source: Bishop, 2021.)

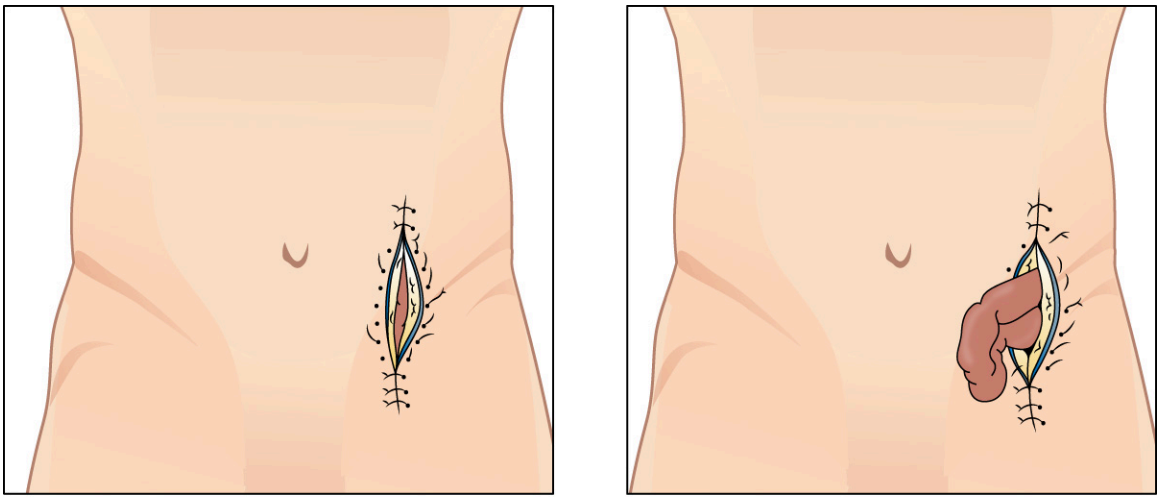
Hemorrhage

Some wound bleeding is normal. Massive bleeding (i.e., hemorrhaging) is abnormal and may be caused by a dislodged clot, slipped stitch, or erosion of a blood vessel by a foreign body. If possible, any dressings should be checked frequently during the first forty-eight hours after the injury and at least every eight hours thereafter. In the event of excessive bleeding, interventions may include packing or applying a pressure dressing, performing surgery, replacing fluids, and monitoring vital signs. Internal bleeding may result in a **hematoma**, a localized collection of blood under the skin that may appear reddish blue and swollen. A large hematoma can be hazardous because it places pressure on blood vessels and causes tissue ischemia.

Dehiscence and Evisceration

The most serious wound complications include dehiscence and evisceration (Figure 8.9). Smoking, obesity, malnourishment, anticoagulant therapy, excessive coughing, vomiting, infected wounds, or straining increase the

risk of dehiscence and evisceration. The partial or total rupturing of a sutured wound is called dehiscence and is caused by excessive stress on unhealed wounds. Dehiscence may be preceded by the presence of serosanguineous fluid from the wound postoperatively. It is common for the patient to say, "It feels like something has given way." The dehisced wound is managed like an open wound. The protrusion of the viscera through the incision when the wound completely separates is called evisceration. This occurs most commonly with abdominal incisions.



(a) Dehiscence (b) Evisceration

FIGURE 8.9 Dehiscence and evisceration are serious complications. Dehiscence may occur from strenuous activity such as coughing or vomiting and can lead to evisceration. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

These complications should be treated like a medical emergency. The patient should be placed in the low Fowler's position and the area should be covered with a sterile towel soaked with sterile 0.9 percent sodium chloride. Placing the patient in the low Fowler's position and slightly bending their knees will lower intra-abdominal pressure on the wound. This will prevent more wound damage until the physician arrives. The provider should be notified immediately because surgical intervention is required. Other nursing interventions include remaining with the patient, providing reassurance, administering intravenous pain medications as needed, and ensuring that the patient remains **NPO** (nothing by mouth).

Fistula

A **fistula** is an abnormal passage from one internal organ or vessel to another or an internal organ or vessel to the outside of the body. Fistulas may be created on purpose, such as an arteriovenous fistula to provide access for kidney dialysis. However, with wound complications, infection can lead to the development of a fistula from an abscess. The collection of undrained infected fluid applies pressure on the surrounding tissue, creating the abnormal passage. Fistulas increase the risk of prolonged healing, skin breakdown, additional infection, and fluid and electrolyte imbalances.

Nursing Interventions Used in Wound Management

Wound care requires an interdisciplinary approach and may require a number of nurses and other healthcare providers to work together. It is essential that nurses understand their role in wound care management to effectively implement interventions within their scope of practice. The nursing role includes assessment and documentation, positioning, dressing care, drain care, suture and staple care, cleaning, debridement, administration of growth factors and heat and cold therapy, wound care education and health promotion, and education of the patient to perform self-care at home. Other therapies that the nurse may be required to assist with include hyperbaric oxygen therapy and surgery. It is important to note that wound care is not 100 percent dictated on the bedside nurse; it can vary based upon specialty background and acute care area. If nurses truly desire to become experts in wound care, they can achieve additional certification and become a certified wound care nurse (CWCN) and ostomy care nurse (CWCON).

Assessment and Documentation

Wound assessment and documentation are crucial aspects of the nurse's role with managing wounds. Some

facilities (e.g., long-term facilities, outpatient clinics, or home care) may take weekly photos to show the progression of the wound healing.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Nursing Interventions for Wound Management

Nurses may encounter wounds that have been treated or untreated but should follow the same core criteria as follows:

- Determine the location and extent of tissue damage.
- Determine or verify the etiology of the wound (e.g., surgery, diabetic ulcer, pressure injury, or accident).
- Measure the length, width, and depth of the wound.
- Assess for any tunneling or undermining.
  - A thin, flexible probe may be used to assess the extent of the undermining.
  - *Cotton tip swabs should be avoided because they may leave behind fibers in the wound.*
- Inspect and document presence and quantity of bleeding or other drainage, both internal and external.
  - Amounts can be estimated by the degree to which the dressing has been saturated (minimal only stains the dressing, moderate may have leakage, heavy overflows the dressings prior to changing).
- Assess the type of dressings in place.
- Assess the patient's vital signs and laboratory results for signs of infection.
- Identify and assess any drains, tubes, sutures, or other type of wound closures that have been used, to include their appearance, drainage, size, swelling, status, and associated pain.
- Inspect for foreign bodies (e.g., soil, shreds of clothing, broken glass, or bullet fragments).
- Determine when the patient last had a tetanus shot if foreign body contamination is present or possible; a booster or immunization may be needed.
- Assess any associated injuries (e.g., fractures, head trauma, or internal bleeding).
- Assess pain associated with the wound (e.g., level, description, location, and things that make it better or worse).
- Assess pain level when providing care; medication may be necessary to limit discomfort during care.

Wound assessment is an ongoing process that requires thorough evaluation and clear, concise documentation for adequate tracking of the healing progression. This allows for continuity of care, adequate care evaluation, and proper interventions or changes in wound care. All photos should be taken with a measuring device (e.g., ruler) placed by the wound to indicate proportions and should be documented and dated for an accurate timeline. In addition to the assessment findings, documentation should also include wound care or therapies provided during the encounter, how well the patient tolerated it, any medications administered and the patient response, any communication to the provider of abnormal findings and whether new orders were received, and any education or supplies given to the patient or family members as well as their understanding of the teaching.

Positioning Devices

Patients who have pressure injuries or have been identified as at risk may benefit from positioning devices to aid in preventing pressure injuries or promote healing. Examples of positioning devices include gel interfaces, foam wedges, or pressure-reducing boots that can be positioned to keep pressure and body weight off bony prominences. If possible, avoid using pillows or other surfaces that collapse under the patient's body weight. These do not provide adequate support. Ring cushions (i.e., donuts) should not be used because they can cause increased venous pressure in the surrounding areas.

Dressings

Wounds may be left open to air or covered with a protective dressing. Wounds may be left open to air per provider order if closing the wound makes infection more likely. Wounds left open to air develop dried eschar or a scab, leading to slower healing. The scab may be inadvertently removed if the area is rubbed or something hits the wound, causing reinjury. Dressings used to cover wounds provide a moist environment that promotes healing. This moist environment aids in rapid epithelial cell migration, maximizing the healing process. Dressings should also be absorbent, provide a barrier from bacteria, limit pain at the wound site, provide thermal insulation, and permit pain-

free removal. Covered wounds help patients cope with the change in their body image.

There is a wide array of dressings used when managing wounds. Different dressings are appropriate for different locations or types of wounds and different stages of wound healing. Although there are many types of dressings, all share the same purposes:

- They provide physical, aesthetic, and psychological comfort.
- They prevent, eliminate, or control infection.
- They absorb drainage.
- They provide moisture balance.
- They guard the wound from added injury.
- They protect the skin around the wound.
- They debride necrotic or damaged tissue, if applicable.
- They promote or optimize the healing process.
- They allow for ease of use and cost effectiveness.

The frequency of dressing changes may not always adhere to a set schedule. Often providers will perform the first dressing change after surgery to afford them the opportunity to assess the incision site. This is generally done twenty-four to forty-eight hours after the procedure. The provider will then write orders dictating the frequency of future dressing changes and products to be used. Excessive moisture can lead to complications. Microorganisms can migrate into the wound site through saturated dressings or from the outer surface of a saturated dressing. Therefore, dressings that are oversaturated or saturated will require more frequent changes or reinforcement with additional dressings. Dressing changes allow for an opportune teaching moment, so that the nurse can demonstrate dressing changes that the patient can do at home. The nurse should encourage the patient to help as much as possible to verify accurate understanding.

Sometimes the patient can struggle with the sight of the wound and not want to look at it. The nurse should listen to what the patient says and pay attention to nonverbal communication. The nurse should provide emotional support and remain patient. Patients with wounds can learn to manage and adjust with the proper support and encouragement.

Various types of wound dressings are available depending on the location, size, depth, and type of wound; the type and amount of drainage; and whether infection is present and debridement is needed. The provider may also have preferences that influence the type of dressings used. The dressings may change as the healing process progresses. The basic primary dressings are those that add, absorb, or maintain moisture. It is the nurse's responsibility to be aware of the products available in the facility they work in and the indications for the various dressing types.

Dry gauze dressings are commonly used to cover wounds, especially surgical-related wounds (Figure 8.10). Dry gauze dressings come in different sizes, such as 2 in x 2 in (5 cm x 5 cm), 4 in x 4 in (10 cm x 10 cm), and 4 in x 8 in (10 cm x 20 cm), and often have multiple layers. They are commonly packaged as single units or in multipacks. The first layer is applied directly to a draining wound and is capable of carrying moisture but is nonabsorbent. This allows the wound to drain into overlying absorbent layers in an attempt to prevent maceration or infection. This dressing type does not commonly stick to the wound and reduces the risk of causing discomfort to the patient. In the event the dressing does stick, sterile saline can be used to loosen the gauze to prevent further injury.

FIGURE 8.10 Dry gauze is commonly used to dress wounds. (credit: "Braided-mesh gauze" by National Library of Medicine, CC BY 4.0)

The next layer is material that will absorb and collect drainage. Cotton-lined gauze sponges or loosely packed gauze wrap (Figure 8.11) are great options because of their ability to pull drainage out by capillary action. The number of gauze sponges or gauze wrap needed is dependent on how much drainage is present. The next layer may be surgical or abdominal pads (ABDs) that help absorb copious amounts of drainage.

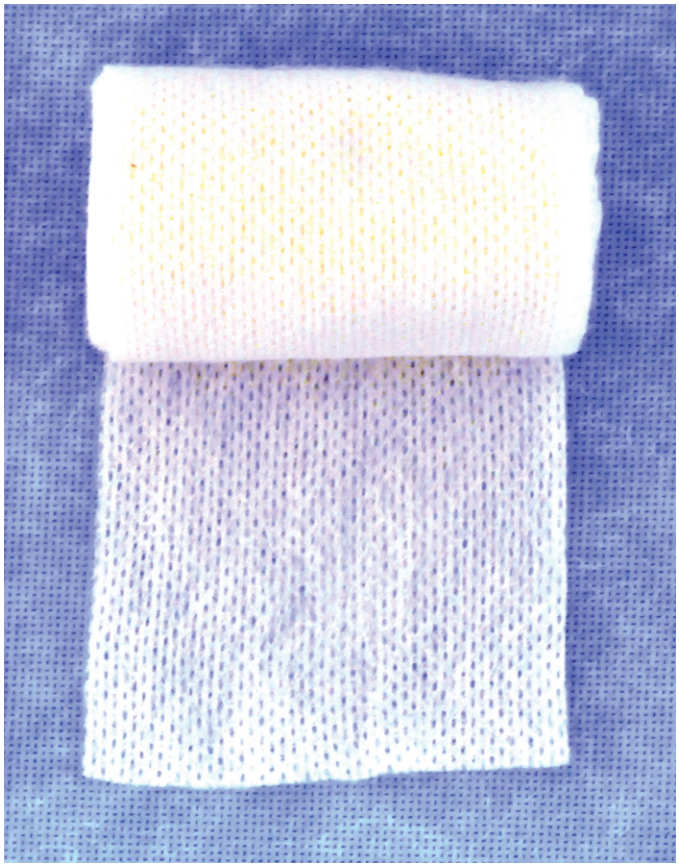


FIGURE 8.11 Gauze wrap can be loosely packed into a dressing to help pull moisture away from a wound. Gauze can also be used as a secondary dressing to hold another type of dressing in the wound bed. (credit: modification of "Combat Gauze" by U.S. Army Materiel Command/Flickr, CC BY 2.0)

Nonadherent gauzes are semipermeable and may be used to allow drainage to pass through and be absorbed by the outer layer. This type of dressing also prevents the outer dressings from adhering to the wound and decreases the risk of injury when removed. Examples include sterile petrolatum gauze and Telfa (i.e., nonabsorbent, nonadherent dressing gauze) gauze and are commonly used on incisions closed with staples or sutures. Precut dressings, such as the Sof-Wick dressing, are available that fit around drains and tubes. Transparent films (e.g., Tegaderm) are

semipermeable membrane dressings that are waterproof and adhesive. These dressings reduce the chance of contamination, are occlusive, and allow for visibility of the wound (Figure 8.12). This type of dressing is commonly used over noninfected healing wounds or intravenous sites.

FIGURE 8.12 Using a transparent dressing to cover an IV site allows the nurse to monitor the insertion site for complications. (credit: "Medics practice their skills" by Master Sgt. Brad Staggs/Defense Visual Information Distribution Service, Public Domain)

With any type of wound, the goal is to keep the wound tissue moist while the surrounding tissues and skin remain dry. This requires continuous dressing monitoring and ensuring the moist dressing solely covers the wound. An absorbent dressing should be used that maintains the wound moisture. The surrounding healthy skin should be kept intact and dry. Moisture-barrier ointments and skin sealants may be used on the healthy skin. The dressings covering the wounds should be secured with the most minimal amount of tape possible or nontape products (i.e., Coban self-adherent wrap).

When foreign material is present, debridement may be necessary. Dressings that promote autolytic debridement include hydrocolloid or transparent films. These occlusive dressings promote the use of the body's own enzymes and defense processes to loosen or soften necrotic tissue. Vacuum-assisted closure (VAC) may also be necessary to promote healing of difficult wounds or in patients with risk factors for delayed healing (such as older adult patients with chronic health conditions) (Agarwal et al., 2019).

Before performing a dressing change, the nurse should inform the patient regarding what will be done. If indicated, prescribed analgesics may be administered thirty to forty-five minutes before the dressing change to limit discomfort associated with dressing changes. Dressing changes should be planned between meals to avoid ruining a patient's appetite. Privacy should always be provided for the patient during dressing changes. The patient should be in the most comfortable position possible throughout the process. Only the necessary area should be exposed during dressing changes, ensuring that the rest of the patient remains draped.

Appropriate aseptic techniques should be used to prevent infection or reinfection. Proper hand hygiene should be performed before and after dressing changes and standard and transmission-based precaution should be followed appropriately. Dehisced surgical wounds require use of sterile technique. Pressure injuries do not require sterile dressings. Nonsterile gloves may be used when providing clean wound care.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Applying a Sterile Dressing

See the competency checklist for Applying a Sterile Dressing. You can find the checklists on the Student resources tab of your book page on openstax.org.

Bandages and binders apply pressure and support the wound in addition to secure the dressing. Bandages that may be used include Kerlix, roller gauze, or ACE (All Cotton Elastic) bandages to wrap a body part to secure the dressing. Rolling bandages are applied starting at the distal end of the area. One hand holds the free end in place while the other hand passes the roll around the body part. Once anchored, the roll is rolled around the body part in a figure eight or circular motion, applying equal tension in all turns and going in the direction of the heart to avoid venous stasis and edema. Each turn should overlap the previous turn by one-half to two-thirds (Figure 8.13).

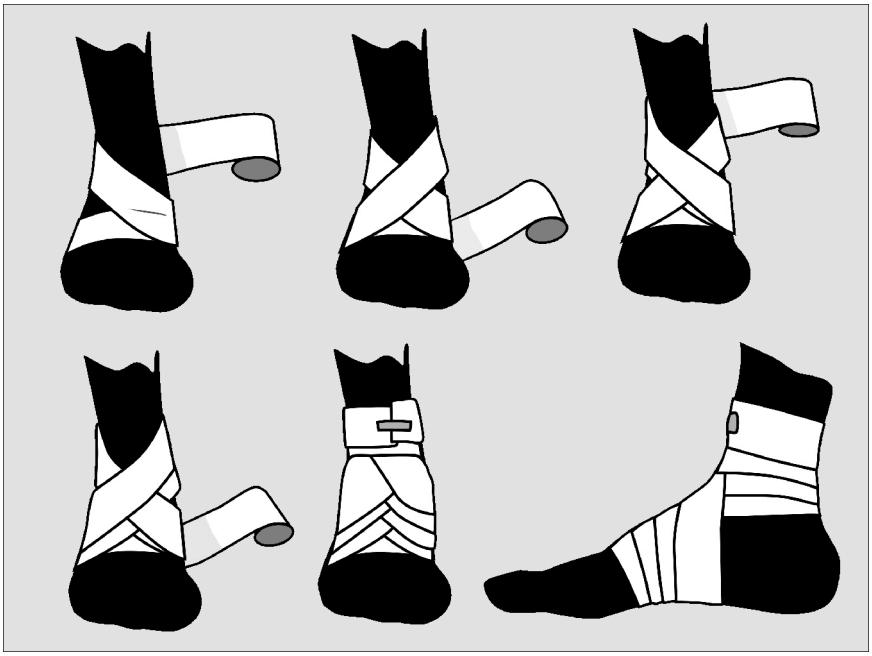


FIGURE 8.13 Bandages are wrapped in a figure-eight style to provide maximum support at points both above and below the affected joint. (credit: modification of "Ankle bandage" by U.S. Navy/Wikimedia Commons, Public Domain)

Binders are designed for a specific part of the body such as abdominal binders, shoulder slings, or chest binders. T-binders are used to secure rectum or perineum dressings. A double T-binder is used for males, and a single T-binder is used for females. The belt should be passed around the waist and then the tails should pass between the legs prior to fastening. Typically, the binders are made of cloth or elasticized material that can be fastened with Velcro. **Montgomery straps** are ties that attach to an adhesive backing that holds a dressing in place. They are useful in preventing skin irritation or tissue damage when retaping is necessary for repetitive dressing changes. The patient's skin should be protected with a skin barrier or hydrocolloid dressing before applying the Montgomery straps. The adhesive backing is applied to the adjacent skin with the ties extending over the wound area. The straps should be untied and turned back during wound changes and retied after the new dressing has been applied.

Drains

Drains are often used with wounds that are expected to have an accumulation of fluid that would impede wound healing (Table 8.10). Drains may be placed during surgery to prevent fluid collection underneath the incision site. Drains, tubes, or catheters may be used in or near the wound site. These are commonly used after surgical procedures in which the surgeon places one end of a drain or tube near or in the area to be drained and passes the opposite end through the skin, through either the incision or a different opening (i.e., stab wound). Drains are either closed or open systems.

Type	Examples	Image
Closed drainage systems have a tube connected to a portable reservoir that provides continual low suction. These are typically sutured to the skin and require emptying to reestablish suction when needed.	Jackson-Pratt drain Hemovac	 (credit: modification of “Surgical drain – waste container” by "26RIJNA2020"/Wikimedia Commons, Public Domain)
Negative pressure wound therapy is a type of closed drainage system that uses a special sponge that works with a semi occlusive barrier that connects to a drainage system.	Vacuum-assisted wound closure	 (credit: “KCI Wound Vac01” by "Noles1984"/Wikipedia, Public Domain) (credit: “KCI Wound Vac02” by "Noles1984"/Wikipedia, Public Domain)

TABLE 8.10 **Different Types of Drains**

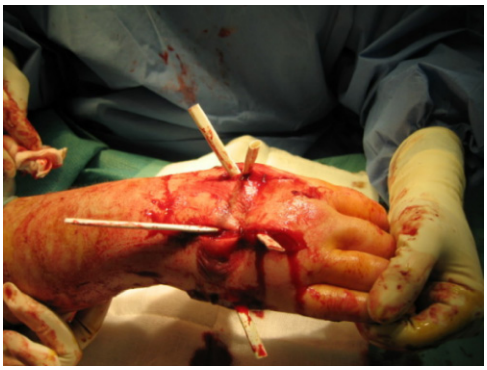
Type	Examples	Image
Open drainage systems do not have a collection device. The drainage empties from the wound or surgical site into absorbent dressings. These are typically sutured in place. The provider may order reducing the length of the drain inside the wound each day. This may be done by clasping the end of the drain with sterile forceps, then pulling it out a small distance using a twisting motion, and then cutting off the end with sterile scissors. A new sterile pin should be placed at the base as close to the skin as possible.	Penrose drain	 (credit: “Compartment syndrome in the hand Intraoperative image of the dorsal region of the right hand” by "Mimarx"/Wikimedia Commons, Public Domain)

TABLE 8.10 Different Types of Drains

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Caring for Drains

See the competency checklists for Caring for a Jackson-Pratt Drain, Caring for a Hemovac Drain, and Applying Negative Pressure Wound Therapy. You can find the checklists on the Student resources tab of your book page on openstax.org.

Sutures and Staples

Sutures and staples are placed by the surgeon or provider to close the wound edges but may be removed by the nurse as ordered. They may be removed after the wound is strong enough to hold its edges together. The length of time needed to develop tensile strength varies among individuals and depends on wound location, age, and nutrition level of the patient. Silk sutures are generally removed after six to eight days to avoid marks; however, the collagen formation and remodeling can take up to three weeks. This may lead to stretching or widening of the scar after the sutures are removed.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Removing Sutures and Staples

See the competency checklist for Removing Sutures and Staples. You can find the checklists on the Student resources tab of your book page on openstax.org.

A suture removal kit is used to remove sutures, and there is a special staple remover for taking staples out. Sterile technique is used during the removal. Hand hygiene should be performed before and after the procedure. The nurse should explain the process to the patient before starting. Any dressings covering the site should be disposed of appropriately. The incision should be cleaned from the center of the wound moving outward. Every other suture or staple should be removed to assess proper healing of wound edges. If the wound is healing properly, then the remaining sutures or staples may be removed. Small, adhesive wound-closure strips may be applied over the wound

to provide support as wound healing progresses, or another dressing type may be applied depending on facility policy or provider preference.

The following are specific instructions for suture removal using the appropriate kit:

1. Use the sterile forceps to grasp the first suture knot and gently lift.
2. Use the sterile scissors to cut one side of the suture underneath the knot and close to the skin.
3. Ensure the knot is still being grasped with the forceps and pull the cut suture through the skin. (The suture should be pulled through by the section of the suture that has been inside the tissue).

Following are specific instructions for staple removal using the appropriate sterile staple remover:

1. Gently position the staple remover under the staple that is being removed.
2. Securely close the remover to straighten the ends of the staple, being careful not to lift up while disengaging the ends of the staple.
3. Gently lift upward with the remover to remove the staple from the incision. If there is resistance, remove one side of the staple and then the other side.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Sterile Field and Sterile Tray Setup

See the competency checklist for Sterile Field and Sterile Tray Setup. You can find the checklists on the Student resources tab of your book page on openstax.org.

Cleaning

Wound cleaning is essential to help remove microorganisms or debris and protect healthy granulation tissue. Normal saline solution (i.e., 0.9 percent sodium chloride) is the typical cleaning agent used in wound care. However, there are other products available such as cleaning antiseptic or surfactant sprays that may be used with infection, debris, or increased amounts of bacterial colonization. Wounds are cleaned after the old dressings have been removed and before applying new dressings. The technique for cleaning wounds with approximated edges differs from wounds with unapproximated edges (Table 8.11).

Approximated Edges	Unapproximated Edges
1. Use standard precautions (implement transmission-based precautions as needed).	
2. Moisten a sterile gauze or swab with the cleansing agent prescribed by the provider.	2. Moisten a sterile gauze or swab with the cleansing agent prescribed by the provider, and then squeeze out the excess.
3. Clean from top to bottom using downward strokes in parallel lines working outward from the incision, and use a new gauze pad or swab for each stroke.	3. Clean in a half- or full-circle motion, starting in the center and then moving outward while using a new gauze pad or swab for each circle.
4. Wipe from the clean to less clean area. (Clean the incision line first because it is considered the least contaminated.)	4. Clean to at least 1 in (2.5 cm) beyond where the end of a new dressing would be.
5. If no dressing is being applied, clean to at least 2 in (5 cm) past the margin of the wound.	

TABLE 8.11 Steps for Cleaning Wounds with Approximated and Unapproximated Edges

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Cleaning a Wound and Applying a Dressing

See the competency checklist for Cleaning a Wound and Applying a Dressing. You can find the checklists on the Student resources tab of your book page on openstax.org.

Open wounds may need to be irrigated during the cleaning process. Irrigation is a direct flow of a sterile solution over the tissues using sterile equipment. Sterile water or sterile 0.9 percent sodium chloride, antiseptic, or antibiotic solutions may be used depending on the provider's order and wound condition. The solution is delivered to the wound using a sterile, large-volume syringe. The wounds may need to be packed and dressed after irrigation to absorb drainage and promote healing of secondary intention. If wound edges are approximated, nonsterile solutions may be used to clean the skin surface.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Performing Irrigation of a Wound

See the competency checklist for Performing Irrigation of a Wound. You can find the checklists on the Student resources tab of your book page on openstax.org.

Growth Factors

Growth factors are naturally occurring polypeptides involved in essential cellular processes needed for tissue regeneration. Growth factors bind to their corresponding receptors on the cell surface to induce signaling pathways to initiate signaling molecules that can stimulate cytoplasmic proteins or prompt the transcription of new proteins (Park et al., 2017). The only exogenic growth factor that has shown to be efficient in treating chronic wounds is the recombinant platelet-derived growth factor (PDGF). This growth factor is synthesized outside the human body and stimulates the immune cells and fibroblasts to prompt the development of the extracellular matrix. Growth factors may be applied topically to the wound by the nurse with an order from the provider.

Hyperbaric Oxygen Therapy (HBOT)

A more advanced wound care therapy is hyperbaric oxygen therapy (HBOT). This technology expedites repair of compromised healing wounds. Patients undergoing this therapy are placed in a pressurized, hyperbaric chamber for generally one to two hours where they breathe 100 percent oxygen. This amount of oxygen enhances the amount of oxygen dissolved in the plasma and also promotes cell proliferation and healing. A highly concentrated oxygen environment boosts wound metabolism, enhances the response to growth factor, activates angiogenesis, and provides antioxidant and antibacterial effects to enhance immune function. Nurses work under the supervising provider to administer this therapy to patients. Patients should be supervised throughout the entire treatment and monitored for adverse effects such as oxygen toxicity, claustrophobia, middle ear injuries, or pneumothorax. Fragranced hygiene products, medical devices such as eyeglasses or hearing aids, jewelry, flammable objects, and electronics should be avoided while inside the chamber (Alemayehu et al., 2019).

LINK TO LEARNING

Patients may be unsure about hyperbaric oxygen therapy and may ask for a reference to review at home. The Food and Drug Administration provides an overview of hyperbaric oxygen therapy for consumers (https://openstax.org/r/77oxyfda) to review.

Heat and Cold Therapy

Heat and cold therapy may be used with wound management. Heat may accelerate the inflammatory cascade of the wound-healing process. The application of heat causes vasodilation, which increases blood flow, reduces blood viscosity, increases capillary permeability that improves delivery of nutrients and leukocytes, helps with pain relief, and reduces muscle tension. Heat may be applied by a moist method (e.g., sitz baths, soaks, warm moist

compresses). Dry heat methods include electric heating pads, hot water bags, chemical heat packs, or dry heating pads powered by hot water (aquathermia).

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Applying an External Heating Pad

See the competency checklist for Applying an External Heating Pad. You can find the checklists on the Student resources tab of your book page on openstax.org.

Sitz baths may be used on the pelvic, rectal, or perineal areas. It may be used after childbirth or to relieve discomfort from a fissure or hemorrhoids. A sitz bath is most often performed on the toilet with a tub lining the bowl. The tub is filled with 3 to 4 in (7.5 to 10 cm) of warm, not hot, water. A bathtub with a special chair and basin may also be used. The patient will submerge their pelvic area for twenty to thirty minutes to aid in reducing inflammation.

Warm soaks consist of the patient submerging a part of their body into warm water or a medicated solution. The warm soak enhances blood supply to the infected area, applies medication to the wound, assists in cleaning sloughing wounds, and improves circulation. The basin or container should be sterilized or cleaned vigorously to reduce the risk of pathogens. The temperature should be between 105ºF to 109ºF (40.6ºC to 42.8 C). The soak may take fifteen to twenty minutes, so the water temperature should be monitored and maintained as needed by discarding some of the fluids every five minutes and replacing them with fresh warm water or solutions. The patient should remove their body part from the container during this process. The container being used should be positioned to promote comfort and proper body alignment.

Moist, warm compresses are used to promote healing and blood flow to the area and also reduce edema. Compresses may be prepackaged supplies from a manufacturer or used by soaking a cloth or towel in hot water and wringing out the excess. A small wet towel can also be placed in a closed plastic bag and warmed in the microwave for one to two minutes after wringing out the excess water. The nurse should test the compress to ensure it is not too hot. This method may cool rapidly due to evaporation, so the compresses should be changed frequently and covered with a heating pad, hot water bottle, or Aqua-K pad. Nurses should monitor the tissue integrity around the wound, ensure the water is not too hot for the patient, and ensure the area is not overhydrated.

Electric heating pads provide even, consistent heat, and they are generally safe to use. The pad can be applied locally to the area and may be used if covered by facility protocol. The patient may be required to sign a release form. The pad should be used according to manufacturer instructions to avoid injury. Pins should be avoided with the use of heating pads because they pose a risk of shock. The pad should be covered with a moistureproof covering that is not too heavy. The heating pad should not be under the body part, or between the body part and a surface such as a mattress, because it could result in burning the linens or the patient. The heating pad should be one that has a limit on how high the pad can be turned up to avoid burning the patient. The nurse should instruct the patient to use the lowest heat setting and not to bypass the auto shutoff to help prevent burns. The nurse should monitor the patient's skin regularly for discomfort, sensation changes, or redness.

Hot packs provide a certain amount of heat within an allotted time frame. They come with instructions on the package that describe activation, which may require squeezing or kneading the pack or even hitting it on a hard surface. The nurse should follow manufacturer directions and follow precautions by monitoring the patient as with the other types of heat therapy methods.

Cold therapy causes vasoconstriction, minimizes muscle spasms, and promotes comfort. Cold therapy also may use dry methods such as cold packs or ice bags. Moist methods include using cold moist compresses. The skin should always be monitored for redness, patient comfort, and sensation changes with any type of cold therapy. In addition, modalities that may have moisture or leakage should be monitored to avoid skin breakdown or overhydration.

Like hot packs, cold packs are also commercially prepared and are sealed containers filled with a nontoxic or chemical substance. Some packs may be kept in the freezer or triggered by squeezing the substance that creates the cold. These packs are easy to mold to fit the body part being used. They should also be covered with a cotton

sleeve so that the pack can be slid onto the extremity or just placed on top of the body part.

Ice bags are inexpensive and fairly easy to use. The bag should be filled about two-thirds full with small pieces of ice. Ice cubes are more difficult to mold to the body part than smaller pieces such as ice chips. Air should be removed from the bag, and the cap should be secured. It is important to ensure the bag does not leak, and a cover should be placed over the ice pack in the event of moisture. The ice pack should only be used for twenty to thirty minutes at a time with an hour break in between uses to prevent overexposure to cold. Patients may use bags of frozen vegetables in place of ice bags at home.

Like their counterpart, moist cold compresses are local applications. They can be used for hemorrhoids or eye injuries. The thickness and texture of the material used are dependent on the area of the body on which it is applied. For example, a washcloth is appropriate for the face whereas a special oval-shaped gauze is appropriate for the eye. The material being used should be submerged in a clean basin or container that has ice and water. The excess water should be removed prior to application. The compress may need to be changed regularly over the twenty-minute therapy because the temperature of the compress will change. The application may be repeated every two to three hours or as ordered. Commercial devices or ice bags may be used to aid in maintaining the cold of the compress.

Debridement

The removal of slough or necrotic tissue and foreign material by various methods is called **debridement**.

There are three types of debridement:

- Using occlusive dressings to enhance the body's own defense mechanisms to liquefy or soften necrotic tissue is called autolytic debridement.
- Applying commercially prepared enzymes that accelerate the body's autolytic process is enzymatic debridement.
- Applying external physical force to remove debris or necrotic tissue is known as mechanical debridement. This method may be accomplished through wound irrigation with pulsed pressure lavage, ultrasound, laser therapy, surgical debridement, or whirlpool therapy.

Wet-to-dry dressings may still be ordered with debridement although there are concerns that this method interrupts angiogenesis. If this method is ordered, it is important that the nurse ensure that the product being used supports moisture balance and that there is no dry gauze in the wound.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety

Definition: "Minimizes risk of harm to patients and providers through both system effectiveness and individual performance" (Quality and Safety Education for Nurses, 2020). The nurse will:

- Describe factors that facilitate a culture of safety.
- Value role in error prevention.
- Describe the benefits and limitations of selected safety-enhancing technologies.
- Value the contribution of reliability for safety.
- Examine human factors and other basic safety design principles.
- Demonstrate effective use of strategies to reduce risk of harm to self or others.
- Examine commonly used unsafe practices.
- Value continuous improvement of own conflict resolution and communication skills.

Certain methods of debridement require special certifications and training due to the invasiveness of the debridement. The nurse must be aware of the skill required to safely debride a wound. A certified wound care nurse possesses the knowledge and skills needed to promote optimal patient outcomes and uses clinical judgment to maintain patient safety.

Surgical intervention may be warranted when other treatment options have been unsuccessful in wound healing. Surgical interventions may include skin grafting, skin flap procedures, or wound closures. Surgical debridement may

also be needed when other debridement techniques have failed, or the extent of the necrotic tissue warrants surgery. Surgical interventions may be selected depending on the patient's condition as well as the severity of the wound. Nursing wound management interventions include ensuring protection of the wound from pressure and infection. Physician orders should be followed for wound care.

Wound Care Education and Health Promotion

Education is a vital component of a nurse's care of patients, particularly when the nurse is preparing the patient for discharge. Education should include the patient and their family members. Continuity of care, whether it is the patient going home or being transferred to another facility or unit, is essential to promote healing and prevent infection or worsening complications. Education may also be taught during home care as well. Education may include at-home wound care and pressure injury prevention.

Patients and their families should be taught about risk factors for pressure injuries, how and where these injuries may arise, and prevention strategies. Any instructions or illustrations provided should be written at a level the patient can understand and in their preferred language. Other education should include proper hand hygiene before and after care as well as the signs and symptoms of infection.

Education and health promotion should include adequate nutrition and hydration to promote wound healing. The nurse should assess for any deficiencies and make recommendations as needed. Regular visits with the provider should also be encouraged, which allows the provider to oversee the progression and quality of wound healing. This also allows the provider to make changes to the healing and wound care processes as needed. If the patient complains of pain associated with wound care, the nurse should educate the patient on using pain medication thirty to sixty minutes before wound care is provided.

PATIENT CONVERSATIONS

Nutrition Education to Support Wound Healing

Scenario: A nurse is providing discharge education to a patient with a stage III pressure injury who will be transitioning to the outpatient wound clinic. During the education, the nurse realizes that the patient does not currently intake enough protein.

Nurse: Alright. So, we have covered everything in your discharge plan. I would like to go more in depth with you about nutrition to ensure we are promoting your healing process. Is that okay?

Patient: Sure. I guess I just don't understand why it matters.

Nurse: Nutrition is vital in the healing process. When your body does not have adequate nutrition, it struggles to promote the adequate healing process. Things such as protein, vitamin C, and fluids are important to intake in adequate amounts. If you have any deficiencies, it may lead to further skin breakdown, electrolyte imbalances, inadequate circulation, and swelling. All of those either slow down healing or inhibits it all together. Does that make sense?

Patient: It does. I drink about 100 oz (3 L) of water a day, and I take a daily vitamin. How do I know if I am taking in enough protein?

Nurse: That is a great question. This actually varies from person to person. Studies have shown that wound healing requires 1.5 grams of protein per kilogram each day (National Pressure Injury Advisory Panel, 2020). So, I see here that you weigh 155 lb (70 kg) and that would equate to 105 grams of protein a day. You can either write down what you eat or track it in an app on your mobile phone to ensure you meet that daily goal.

Patient: Oh, like that MyFitnessPal my daughter put on my phone?

Nurse: Yes, sir. Have you used it before?

Patient: Well, I played with it when she first installed it. It seems pretty easy. I just stopped using it when I was in the hospital.

Nurse: Okay. Do you need help using it at all?

Scenario follow-up: The patient got his phone out and opened the app. The patient was able to input various food items with little assistance. This return demonstration allowed the nurse to assess that the patient was able to perform this task.

Nurse: I am glad you are able to use the app. If you do not want to use an app, you can always keep a handwritten food journal. What kind of protein do you usually enjoy eating?

Patient: Steak or any kind of beef, cheese, and pork.

Nurse: Okay, do you enjoy chicken, eggs, or any dairy products?

Patient: Yeah, I do, and I do eat those.

Nurse: Great. Those are also great sources of protein as well as nuts, seeds, nut butters, beans, lentils, and edamame.

Patient: Oh, I do enjoy a lot of those as well. Sometimes I only eat breakfast and dinner, so I do not think I get 106 grams of protein in a day. I just have not been hungry lately.

Nurse: You can supplement your diet with things like protein shakes or drinks to aid boosting your protein intake. I have a list here that I am going to send you home with. It includes protein and other food groups that support wound healing.

Patient: That will be great. My wife would like that.

Nurse: Of course.

Any education provided to the patient and their family should be evaluated. The patient and family should verbalize understanding or give a return demonstration. The patient or family should be encouraged to participate in wound care, so that the nurse has a chance to reinforce or confirm proper care techniques.

Teaching Self-Care at Home

Teaching self-care at home should cover supplies, infection prevention, and wound healing. Supplies should be easily attainable so the patient can perform care at home. The nurse should consider cost and ease of use when making recommendations on how the patient can obtain supplies. Most supplies are available from a medical supply store, discount store, drug store, or pharmacy. The patient may have preferences in regard to the location of the store relative to their home. Insurance companies may reimburse or provide financing for supplies, so the nurse should encourage the patient to follow up with their insurance provider.

Infection prevention is paramount with wound healing because infection can slow wound healing or cause further complications. The nurse should provide education on proper hand hygiene, glove usage, and wound care steps. The patient and family should be educated on signs and symptoms of infection and when to notify the provider. Signs and symptoms include fever, flu-like symptoms, increased pain, thick drainage with a foul odor that may be yellow tinged, and red or separated wound edges. The education should also include instructions on proper disposal of old dressings (e.g., putting old dressings in a plastic bag and placing them in the trash bin).

Wound healing self-care should focus on promoting optimal healing. The education should cover balanced nutrition that is high in protein and vitamins as well as drinking at least 48 to 64 oz (1.5 to 109 L) of hydrating fluids. Rest periods should be encouraged during the day to avoid overexertion or injury. The patient may also need modifications surrounding their activities of daily living until the healing is complete. The provider may have restrictions or recommendations to follow, which should be taught to the patient. The family should be educated as well to be able to help the patient and ensure compliance. Patients who struggle with an altered body image or difficulty coping with the wound and activity restrictions may benefit from counseling in a group setting or with a one-on-one therapist.

8.4 Burn Injuries and Management

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the different types of tools used for burn assessments
- Describe the nurse's role in burn injury management
- Recognize complications that occur in different body systems because of burn injuries

Globally, more than 175,000 deaths related to burns occur annually (World Health Organization, 2018). The skin is the largest organ of the body. Burns on the skin can range from very small to covering large portions of the body. They can range from mild to life-threatening based on the cause, depth, and amount of surface tissue they cover. While they are wounds, they are frequently more complex than wounds we have discussed thus far. Furthermore, their impacts on the body are somewhat different based on the cause, requiring different types of assessment and management and creating different types of complications. Severe burns impact health, well-being, and mortality for up to ten years after the initial injury (Jeschke et al., 2020).

Burn Injury Assessment

Burn injury assessment is similar to assessment of other wounds. The burn itself must be examined to determine treatment and management. However, the type of burn must also be known. As with the cause of some types of wounds, such as diabetic foot ulcers, the cause of the burn is critical to ensuring appropriate treatments. Finally, burn assessment includes the percentage of the body surface that was burned. Clinicians use these three factors to develop management and treatment strategies for patients with burns: burn level or degree, cause, and amount of impacted body surface.

CULTURAL CONTEXT

Populations at Higher Risk

Due to differences in access to medical care and issues of healthcare equity, higher risk populations, such as immigrant populations, people with low incomes, or people who are marginalized or are experiencing homelessness, are more likely to experience burns and are less likely to have access to all the supportive care needed to return to their full health and baseline. Organizations such as the World Health Organization and the American Burn Association are actively engaged in decreasing the burden and risk of burn-related injuries for these populations, through lobbying for legislative changes (such as decreased flammability for children's clothing) and engaging in grassroots fire-prevention campaigns (Jeschke et al., 2020).

Burn Levels

Burn levels are determined by the depth of related tissue damage. They are classified into one of three types based on how deeply the burn extends into the skin (Table 8.12 and Figure 8.14).

Burn Level	Skin Involvement	Signs	Example	Duration
Superficial (first-degree) burn	Epidermis only	Warm, red, painful, soft, blanches when pressed	Sunburn	Usually self-limiting and resolves in a few days
Partial-thickness (second-degree) burn	Epidermis and into dermis	Very painful, red, blistered, moist, blanches when pressed	Burn from hot liquid or surfaces	Requires treatment and healing of three to eight weeks

TABLE 8.12 Burn Classification Levels (Source: Schaefer & Szymanski, 2023; Jeschke et al., 2020.)

Burn Level	Skin Involvement	Signs	Example	Duration
Full-thickness (third-degree) burn	Epidermis, all of dermis, into subcutaneous fat or deeper structures	Not painful, white, brown, or charred, firm and leathery texture, no blanching	Flames, superheated gases	Requires extensive treatment and healing of several months
Fourth-degree burn (described in some sources)	Epidermis down into bone and muscle	Blackened skin and tissues, life-threatening	Burn from a building fire	Frequently leads to amputation; very long recovery

TABLE 8.12 Burn Classification Levels (Source: Schaefer & Szymanski, 2023; Jeschke et al., 2020.)

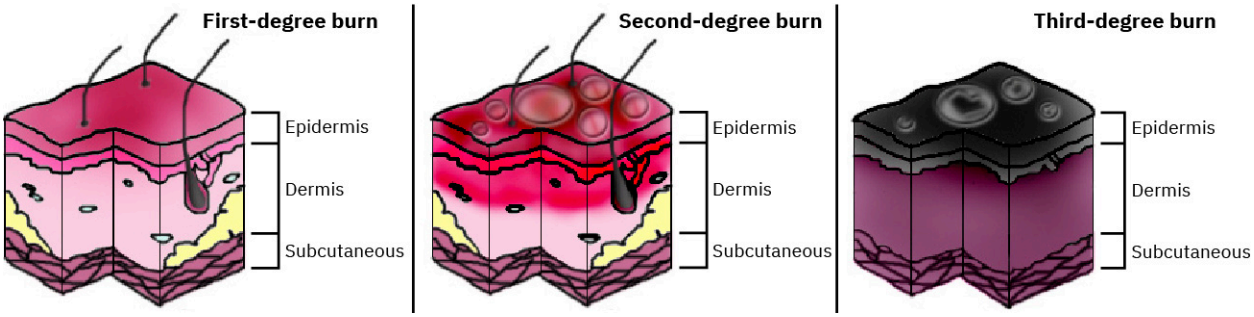


FIGURE 8.14 Compare the differences between first-, second-, and third-degree burns. (credit: modification of "Burn Degree Diagram" by "Persian Poet Gal"/Wikimedia Commons, CC BY 3.0)

Types of Burns

The cause of burns greatly impacts their treatment. Burns can be caused by a variety of environmental exposures. Heat, chemicals, radiation, and electricity all cause burns. Any of them can be life-threatening if they are severe enough. It is critical for nurses to understand and recognize the various types of burns and the care required for each of them.

Thermal Burns

Burns related to temperature, known as **thermal burn**s are arguably the most common type of burn for which patients seek treatment (Table 8.13). The severity of the injury depends on the degree of the exposure and the amount of time the skin was exposed (Figure 8.15) (Żwierełło et al., 2023).

Burn Type	Description
Hot liquids	• Also called scalding • Caused by exposure to hot liquids • Superficial to partial-thickness burns that heal • Most common burn in children
Dry heat	• Usually caused by direct contact with flame or radiant heat source • Usually causes partial- to full-thickness burns that require surgery • Complicated by other injuries such smoke inhalation

TABLE 8.13 Different Types of Thermal Burns (Source: Żwierełło et al., 2023; Jeschke et al., 2020.)

Burn Type	Description
Contact injury	• Caused by touching a hot object • Often occurs when a person is unable to move away from a hot object (e.g., due to a seizure, mobility issues, or loss of consciousness) • Frequently causes full-thickness burns that require surgery
Extreme cold	• Also called **frostbite** • Occurs when water in the tissue freezes • Causes deep-tissue injury and may lead to tissue death (necrosis)

TABLE 8.13 Different Types of Thermal Burns (Source: Żwierełło et al., 2023; Jeschke et al., 2020.)

FIGURE 8.15 Note the severity of the third- and fourth-degree burns that covers this patient's entire torso. (credit: "A full-thickness 3rd degree thermal burn" by Żwierełło et al., CC BY 4.0)

REAL RN STORIES

Burned Patient

Nurse: Beth, BSN
Clinical setting: Step-down unit
Years in practice: 25
Facility location: Suburb in Georgia

Our hospital is part of a hospital group here in Georgia. We all use the same policies and procedures and generally follow the same rules. One day, engineering came in to reset all of our blanket heaters five degrees lower than we kept them, and locked them at that temperature. Several of us were frustrated because we felt like the temperature was set too low to really help patients when they were cold, and we knew that we would have to change out their blankets more frequently. Then we received an email from the patient safety office that we were not allowed to use the microwave to heat towels or blankets for patients. Then, a new policy came out about various heat sources and patients, which we all had to read and sign.

At the next staff meeting, we asked our nurse manager if we could get the temperature turned back up on the blanket heater. Our manager told us that there had been an incident in the ICU of one of our company's other

hospitals. A nurse had microwaved a towel to warm it up and left it in a wrapped/rolled up position. Then she placed it on a patient's chest without unwrapping. The towel continued to increase in heat since it was not exposed to environmental temperatures and burst into flames, burning the patient. Once we got over being horrified about that thought, our manager explained further.

After the incident, the safety department looked at all of the ways that we provide heat for patients and compared them with national guidelines. To prevent any future events, they had developed a new policy about heat sources and also determined to set all blanket warmers across the entire agency at the same temperature, with no exceptions or alterations. I cannot say that I blame them, but what a horrible way to realize there is a potential problem.

Chemical Burns

Accidental burns caused by exposure to various chemicals are known as **chemical burn**s. Most occur at home or in various industries; however, chemicals have been used intentionally in targeted attacks against individuals or groups, and in warfare. The severity of chemical burns depends on the type of chemical, its concentration, the body surface exposed, the amount of exposure time, and the action of the specific chemical (Table 8.14) (Żwierełło et al., 2023). When a patient has been exposed to a chemical, always research the effects of that chemical. Some readily absorb and continue to impact the skin and underlying structures well after the chemical itself has been washed off.

Chemical Class	Examples	Burn Characteristics
Acid	Hydrofluoric, acetic, formic, sulphuric, nitric, hydrofluoric	• Localized and temporary • Destroys proteins in skin and causes localized necrosis
Alkali	Sodium hydroxide, potassium hydroxide, calcium hydroxide, ammonia	• Causes progressive **liquefaction necrosis** (liquefaction and death of body tissues) • Penetrates deeply • Continues to impact tissues after being removed
Oxidizers	Bleaches, peroxides, chromates	• Pain, redness, localized swelling, and blistering
Miscellaneous	Hair dye, mustard gas, white phosphorus	• Varies by type; may include respiratory distress and blistering

TABLE 8.14 Chemical Classes and Burn Characteristics (Source: Żwierełło et al., 2023; Jeschke et al., 2020.)

CULTURAL CONTEXT

Risk of Chemical Burns for Farmers

Farmers are at high risk for chemical burns from the chemicals they use on their fields, particularly nitrogen fertilizers such as anhydrous ammonia. Anhydrous ammonia is a desiccant—it pulls out all moisture from any surface it touches, including the skin—and causes caustic burns and then freezing due to the rapid loss of body heat. When providing care for patients who are farmers, provide safety information to prevent chemical burns. Encourage them to use appropriate personal protective equipment whenever dealing with fertilizers. If exposed, they should immediately flush the skin with gallons of water and seek medical treatment (Minnesota Department of Agriculture, n.d.; Doss, n.d.).

Radiation Burns

Radiation burns are caused primarily by three different types of rays; alpha, beta, or gamma (Żwierełło et al., 2023). Exposure may occur during cancer treatment. Alpha rays cannot penetrate the skin but cause extensive internal burns if inhaled or ingested. Beta rays only penetrate a short distance into the skin and cause superficial burns. Gamma rays penetrate deeply into the tissues, causing full-thickness burns, and also impact internal organs such as the lungs. Patients exposed to gamma radiation are also at risk of **acute radiation syndrome (ARS)**. ARS is an acute illness related to full-body exposure to high levels of radiation (Centers for Disease Control and Prevention, 2018). It may impact the cardiovascular system, gastrointestinal tract, and/or bone marrow and is frequently fatal.

Electrical Burns

Skin is not a good conductor of energy. When an electrical source meets skin and generates heat, damaging local tissue and causing an electrical burn. Severity of electrical burns is determined by several factors: the amount of electricity (voltage), the type of current (AC or DC), how long the contact was made, and how the electricity travels through the body (Żwierełło et al., 2023). Electricity will find a way to move through the human body, and with severe electrical burns there will be visible burns at both the entry and exit points(Figure 8.16). Approximately 5 percent of all burns are electrical burns (Żwierełło et al., 2023). Nursing considerations for patients with electrical burns include the following:

- Always check for entrance and exit points with electrical burns.
- If there are entrance and exit points, all the tissue between the two points is also burned and impacted by the movement of the electricity through the body.
- Internal electrical burns can cause cardiac arrhythmias, muscle breakdown, renal failure, and other difficulties.
- Always examine patients with electrical burns for injuries related to falls as they frequently fall after the electrical shock (Żwierełło et al., 2023).

(a) (b) (c)

FIGURE 8.16 These images show various electrical burns: (a) electrical burn entry wound; (b) electrical burn exit wound; (c) electrical burn on the hand. (credit: (a) modification of "Electrical burn entrance wound" by OSHA/Wikimedia Commons, Public Domain; (b) modification of "Electrical burn exit wound" by OSHA/Wikimedia Commons, Public Domain; (c) modification of "Electrical burn on hand" by NIHOSH/Wikimedia Commons, Public Domain)

Percentage of Body Surface

The percentage of the body's surface that is burned is the third important issue to assess. The greater the **total body surface area (TBSA)** of a burn, the higher the likelihood of serious complications and death (Żwierełło et al., 2023). For example, if more than 30 percent of the TBSA is burned, hypovolemia is likely as the body loses blood, plasma, and fluid through the exposed tissues and the inflammatory system goes into overdrive. This can lead to **burn shock** in which the circulatory system becomes dysfunctional and unable to compensate for the loss of blood, plasma, and fluid, even with aggressive fluid replacement (Jeschke et al., 2020). This in turn may lead to cardiac dysfunction, inadequate tissue perfusion, and potential organ failure (Żwierełło et al., 2023). TBSA covered in a burn can be determined by two strategies: **Rule of Nines** and the **palmar method**.

CLINICAL JUDGMENT MEASUREMENT MODEL

Recognize Cues: Determining TBSA of a Patient's Burn

For most patients, determining the percentage of their body surface covered in a burn will be determined by using one of two strategies.

- Rule of Nines is common for burns over large surface areas (Figure 8.17). The head and each arm represent 9 percent each of TBSA. The chest and abdomen, entire back, and each leg are 18 percent each. The perineal area is 1 percent. Thus, a patient whose entire right arm and back were burned would have a TBSA of 27 percent.

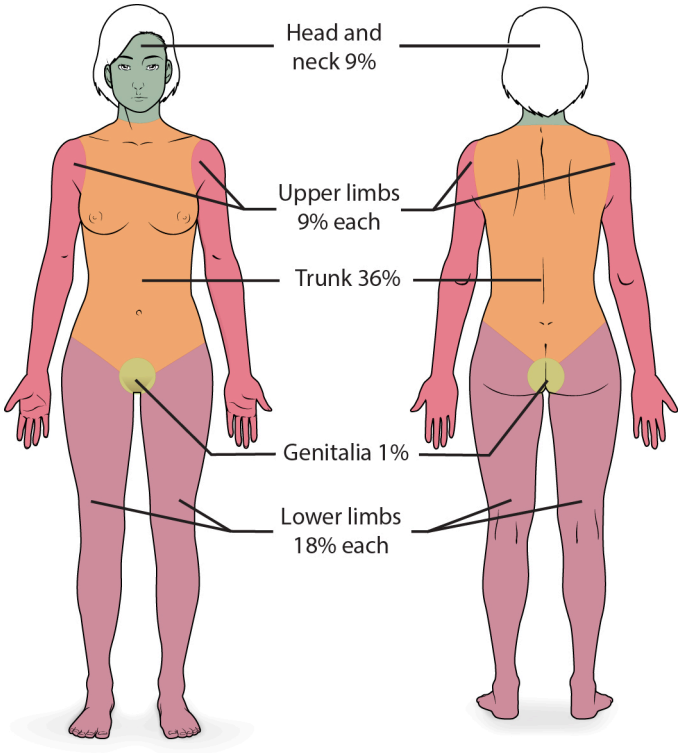


FIGURE 8.17 Using this image, it is easy to calculate the burn percentage for a patient. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

- The palmar method is used for smaller burns. With this method, look at the patient's palm, not including their fingers. A burn the size of their palm will be an estimated 0.5 percent of their TBSA. A burn the size of their palm including their fingers will be an estimated 1 percent of their TBSA.

Remember, only partial- and full-thickness areas of burning are considered when determining TBSA for medical treatment (Schaefer & Szymanski, 2023).

Burn Injury Management

The goals of burn care are simple: "no death, no scar, no pain" (Jeschke et al., 2020). When a patient comes into the emergency department, urgent care center, or provider's office with a burn, the assessment of burn type, cause, and affected TBSA will dictate the initial burn management. Most minor burns can be treated in any healthcare area. These should be treated with a Four Cs approach:

- Cool the burn with tap water or saline.
- Clean the area with mild soap and water, leaving smaller blisters intact.
- Cover the burn with topical antibacterial ointments and dressings.
- Provide comfort via pain medications (prescription or over the counter) and/or splints for support

More severe burns require different levels of burn management. In the United States, most patients with burns

greater than 10 percent of their TBSA, burns that are full-thickness, burns to sensitive areas (face, hands, feet, genitalia, joints), chemical or electrical burns, and/or associated traumatic injuries are transferred to burn centers for treatment (Schaefer, 2023).

The immediate steps after a burn involve removing the cause of the burn (Żwierełło et al., 2023). For thermal and electrical burns, the cause will be removed prior to the patient arriving in the healthcare location. For chemical and radiation burns, this is frequently not the case, and these patients must undergo **decontamination** (removal of residual chemical or radiological particles) prior to receiving full assessment and treatment (Figure 8.18). Decontamination should be performed prior to transfer of a patient to a burn center.

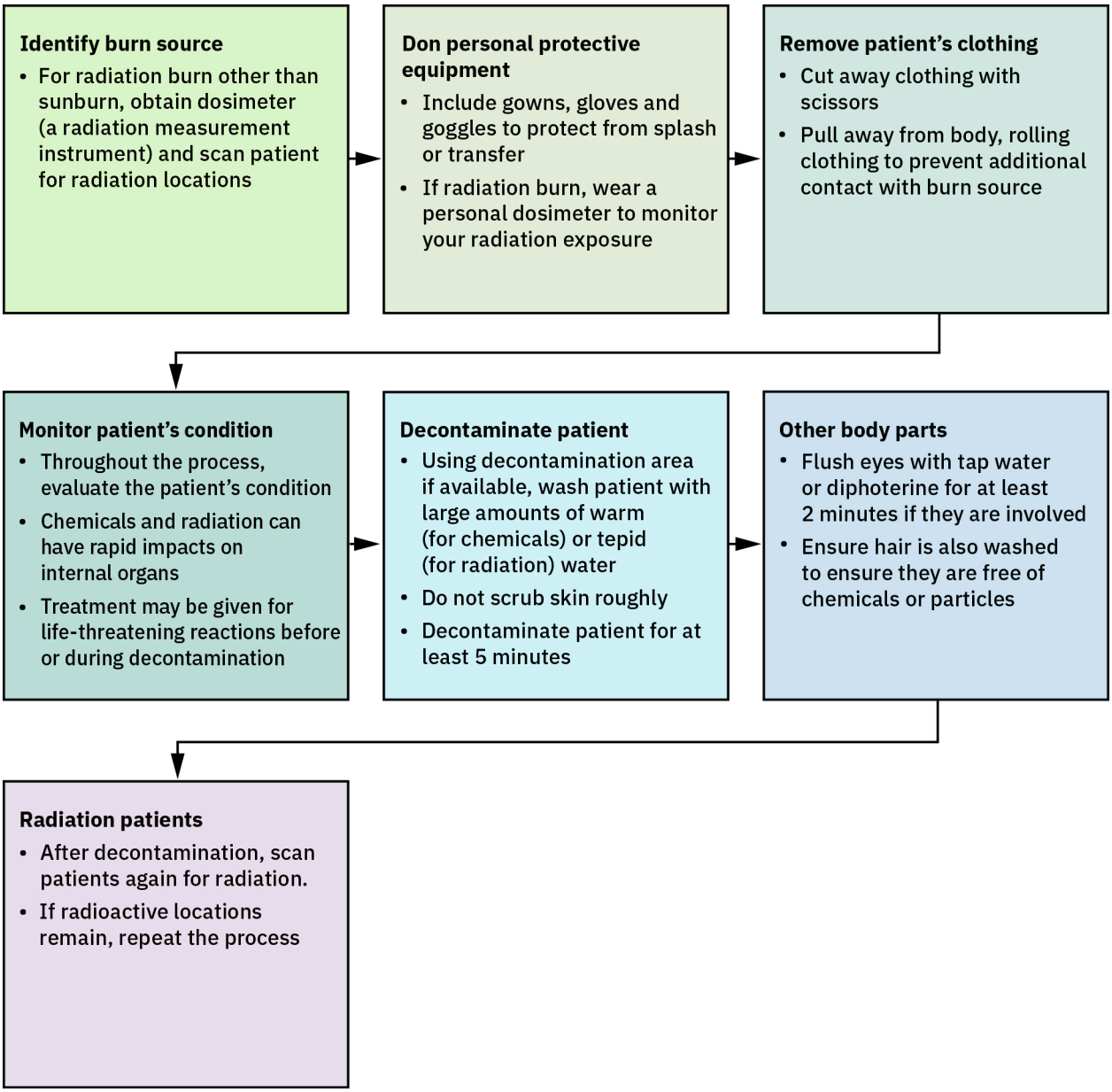


FIGURE 8.18 Decontamination is a critical first step for patients exposed to chemicals and radiation (Chilcott, 2019; Occupational Safety and Health Administration , n.d.; Collins et al., 2020; Wiesner et al., 2019; Centers for Disease Control and Prevention, 2018). (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

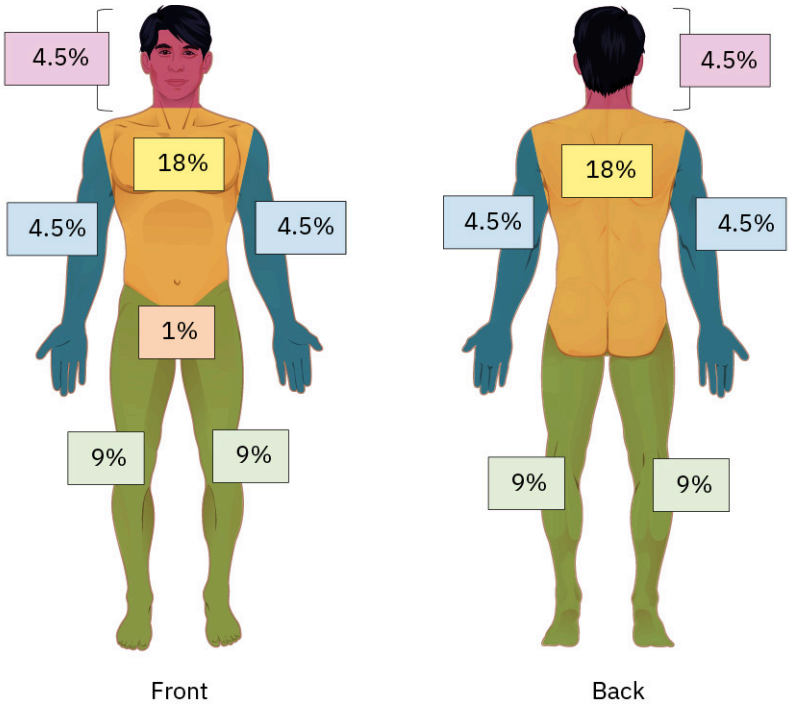
Resuscitation for Burn Injury

Once any needed decontamination is completed, perhaps the most important component to managing patients who have been burned is **fluid resuscitation**, which is the administration of IV fluids to ensure adequate intravascular fluid. With burns, the body quickly sends fluids into the damaged tissues as part of the body's attempts to return to homeostasis (system stability or equilibrium) (Żwierełło et al., 2023). A type of shock due to decreased fluid volume

in blood vessels that impacts the blood flow and transport of oxygen to organs and tissues known as **hypovolemic shock** is a real risk for patients with burns that cover more than 10 percent of TBSA (Carter, 2022). Hypovolemic shock occurs because vasodilation and capillary permeability, due to the immune and inflammation process happening on a systemic level, allow fluids to shift in the vasculature into tissue spaces.

Parkland Burn Formula

The **Parkland burn formula** is a commonly used formula for determining the amount of fluid resuscitation is needed for patients who have been burned (Figure 8.19). The goal of fluid resuscitation is maintaining a urine output greater than 0.5 mL/kg/hr. It should begin as soon as possible for patients with burns covering 20 percent or more TBSA, even before patients are transferred from their initial triage location.



Parkland Burn Formula

Amount of fluid for first 24 hours = 4 mL LR × patient's weight (kg) × TBSA %

First 8 hours = 1/2 of total	Next 16 hours = 1/2 of total	
Example 80 kg patient with 40% TBSA = 4 × 80 × 40 = 12,800 mL	Hours 1–8 = 6,400 mL or 800 mL/hour	Hours 9–24 = 6,400 mL or 400 mL/hour

FIGURE 8.19 The appropriate lactated Ringer's (LR) fluid replacement amount is calculated using the Parkland burn formula, using patient weight and TBSA burn percentage (Adapted from Schaefer & Szymanski, 2023). (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Improving Care Coordination

Second- and third-degree burns typically require lengthy hospital admissions and complex treatment regimens. As previously mentioned, patients with severe burns should be transferred to designated burn centers that have large interdisciplinary teams dedicated to meeting the complicated needs of patients who have been burned. However, up to 20 percent of the U.S. population does not reside near a burn center, a situation that is much more severe in other countries (Jeschke et al., 2020). No matter where care is provided, patients who have been burned require a well-

coordinated and large interdisciplinary team (Table 8.15) (Johns Hopkins Medicine, n.d.).

Multidisciplinary Team	Burn Program Services
• Providers, including plastic and orthopedic surgeons, infectious disease providers, and hospitalists • Nurses specializing in burn care • Psychologists/psychiatrists • Physical, occupational, respiratory, and recreational therapists • Dieticians • Social workers, case managers, and vocational counselors	• Wound care and pain management • Physical therapy and occupational therapy to prevent contractures and manage activities of daily living • Surgical procedures including cosmetic reconstruction and skin grafting • Psychological counseling for patient and family and medications as needed to manage depression, grief, fear, and anxiety • Nutritional counseling • Job counseling and retraining

TABLE 8.15 Care Coordination in Patients Who Have Been Burned

Complications of Burn Injury

In addition to suffering the acute effects of burns, patients are also at risk for complications and associated injuries. Patients who have been burned may also have inhalation injuries, fluid imbalances, body temperature abnormalities, and other physical injuries. They are also at risk for infection and limited mobility, depending on the nature and extent of their injuries. All patients are also at risk for psychological trauma from both the experience of being severely injured and the process of healing and adapting to any permanent changes the injuries may have caused. It's important for the nurse to be aware of the potential long-term consequences of burn injuries so they can assess and monitor patients for progress and signs of complications.

Respiratory Complications

Respiratory complications are also common with burns, particularly in patients who also experienced **inhalation injuries** caused by breathing in particulates such as smoke, exposure to extreme temperatures such as heat from fires, or chemical burning of upper airways (Żwierełło et al., 2023; Jeschke et al., 2020). Inhalation injuries related to burns fall into three categories: system toxicity related to chemicals such as carbon monoxide and cyanide, thermal injuries to upper airway, and chemical injuries to entire airway (upper and lower) (Jeschke et al., 2020). It is important for the nurse to take note that burns on the head, neck, and chest can be correlated to inhalation injuries, and to aggressively protect a patient's airway by anticipating intubation and mechanical ventilation.

Low Blood Volume

Hypovolemia can lead to burn shock. When a burn occurs, particularly a second-degree or greater burn over more than 10 percent of the TBSA, the body loses intravascular and interstitial fluid as the natural immune response rushes to manage the wound (Jeschke et al., 2020). However, with burns, the human immune response tends to overcompensate at the wound site, which can negatively impact blood volume to the rest of the body, including the heart. As a result, even with aggressive fluid resuscitation, cardiac function can become impaired, decreasing oxygenation to tissues. The combination of low blood volume in the vascular system with cardiac dysfunction can affect other internal organs as well.

Thermoregulation

For patients with burns covering more than 40 percent TBSA, particularly those with thermal burns, loss of thermoregulation (the body's ability to regulate its own temperature) is a potential complication (Żwierełło et al., 2023). When thermoregulation is disrupted for patients who have been burned, they become prone to hypothermia (an abnormally low body temperature).

Infection

Infections, particularly sepsis (multiorgan, systemic infection), are common among patients with burns due to large areas of exposed tissue and the dysregulation of the immune system as discussed previously (Jeschke et al., 2020). Patents with burns are particularly susceptible to bacterial infections, but also fungal, yeast, and even viral

infections. Nurses have a responsibility in preventing infection. Examples include strict hand hygiene, contact precautions, wearing a mask, inherent and gloves, essentially placing a patient in a more protective isolation because they won't be able to fight off an infection, like a healthy individual so they need to be protected from the outside world. Prevention and early identification of infection are critical components of burn management. Nurses should expect to use strategies, such as using topical antibiotic ointments and culturing wound sites when infection concerns arise (Żwierełło et al., 2023).

Scarring, Contractures, and Mobility

Burns scars can be physically traumatic for people who have been burned and can have profound and permanent impacts on mobility. Because scar tissue is not elastic, it causes skin mobility to become restricted, which can also affect joint mobility (Figure 8.20).

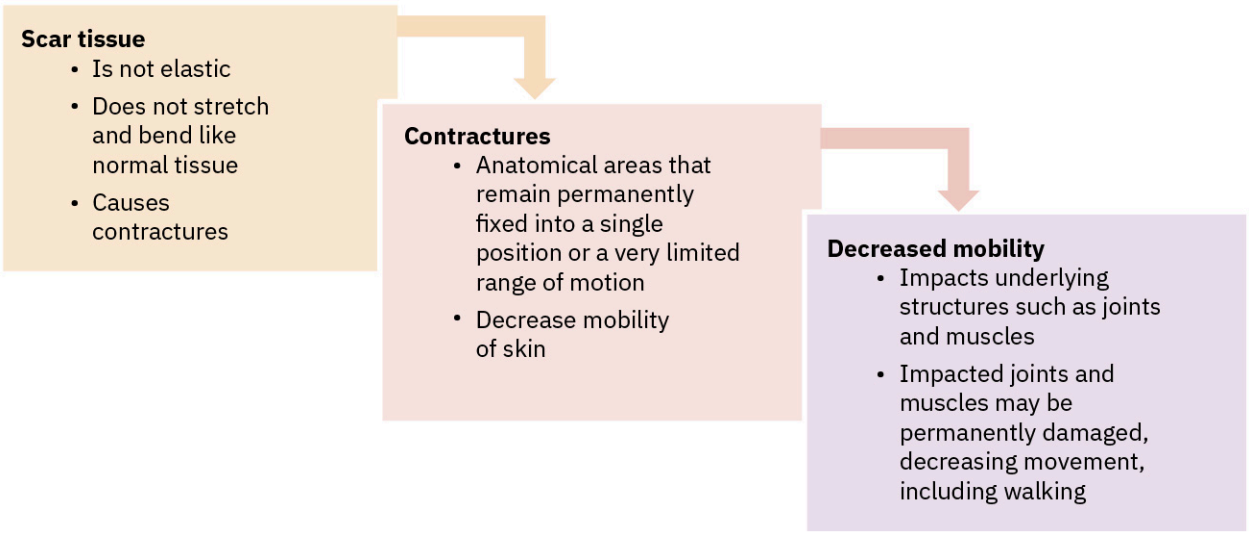


FIGURE 8.20 Scar tissue can have permanent impacts on mobility (Żwierełło et al., 2023). (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Prevention may include physical therapy, splinting (holding a body part in a desired position with medical aids), and reconstructive surgery, such as **skin grafting** (a piece of healthy skin is transplanted from one area of the body to another). Skin grafting is often used to decrease the impacts of scarring and improve both appearance and the use of affected areas (Żwierełło et al., 2023).

Psychological Trauma

Severe burns and trauma can lead to profound psychological trauma. Patients with minor burns experience more depression and anxiety than the general population (Jeschke et al., 2020). Many studies have shown that patients who have suffered severe burns report lower quality of life and increased anxiety, pain, and depression even after their physical wound has healed (Jeschke et al., 2020). Furthermore, there is strong evidence that patients who experience severe burns, depression, and post-traumatic stress experience difficulties returning to their normal lives (Jeschke et al., 2020). Thus, early and regular mental health assistance and services are an important component of interdisciplinary teams, to assist with psychological trauma related to the burn and encourage healthy recovery.

LINK TO LEARNING

Patients with burns experience many changes. The Model Systems Knowledge Translation Center (MSKTC) has a variety of patient education tools for people living with severe burn injuries (https://openstax.org/r/77MSKTC) to explore.

Summary

8.1 Wound Classification

Wounds are classified in several ways and include intentional or unintentional wounds (i.e., from treatment/therapy or accidental), open or closed wounds (i.e., break in the skin or under the skin layers), acute or chronic wounds (i.e., follows normal healing process or is delayed and does not follow normal healing process), pressure injuries, and friction and shear. Pressure injuries are localized ischemic lesions of the skin and underlying tissue caused by external pressure that impair blood and lymph flow. Friction and shear are mechanical forces that tear and injure blood vessels and can contribute to the development of pressure injuries.

Risk factors for development of pressure injuries include exposure to excessive moisture, malnutrition and dehydration, and decreased mobility and cognition. Moisture weakens the skin integrity and makes it more susceptible to breakdown and infection. Malnourishment leads to cell damage, inadequate perfusion, and lack of padding for bony prominences. People who have mobility issues or are bedridden are unable to adjust themselves in response to pressure and are often in one position for a prolonged period of time. Those with altered mental status and who have decreased awareness (e.g., unconsciousness, sedation, or dementia) are at risk because they are less likely to recognize and respond to the discomfort from pressure.

Depending on the extent of damage, pressure injuries are assessed and classified as stages I through IV and as deep tissue or unstageable. A stage I pressure injury is characterized by localized, nonblanchable erythema of intact skin. Stage II pressure injuries are characterized by Partial-thickness (second-degree) skin loss involving the epidermis or dermis. Stage III pressure injuries are characterized by full-thickness skin loss in which the adipose, granulation, and deeper tissues are visible and may have a presence of slough or eschar. Stage IV pressure injuries are characterized by full-thickness skin loss with extensive destruction, necrosis, and exposed or palpable fascia, tendon, ligament, muscle, cartilage, and bone. Slough and eschar are often visible along with epibole, undermining, and/or tunneling. Deep-tissue pressure injuries are characterized by persistent, nonblanchable areas of intact skin that have maroon, deep red, or purple discoloration. Pressure injuries are classified as unstageable if they have full-thickness skin or tissue loss with excessive slough or eschar that obscures the extent of the damage.

8.2 Wound Assessment

Whether in physician's offices, emergency rooms, or inpatient facilities, the nurse will encounter patients with wounds. Understanding wound assessment and description, such as appearance and types of wounds, is a critical skill for any registered nurse. There are many tools available to help nurses and other healthcare professionals assess and document wounds. Tools such as the Braden Scale and Wagner Ulcer Classification System assist healthcare providers in establishing a patient's risk for developing wounds or experiencing complications from them. These tools and effective, knowledgeable assessment allow nurses to provide appropriate documentation, which can be used by other providers to effectively manage patient care and ensure accurate and timely treatment.

8.3 Wound Management

Wound management encompasses many nursing interventions that are essential for promoting healing and tissue regeneration. To effectively manage wounds, nurses must understand the phases of wound healing, factors affecting wound healing, psychological effects of wounds, complications affecting wound healing, and the nurse's role in wound care management. Wounds are healed by primary, secondary, or tertiary intention. Wound healing can be broken down into the following phases: hemostasis, inflammatory phase, proliferation phase, and maturation. Several factors may influence the speed of wound healing and may be localized or systemic. Localized factors are those factors that occur directly in the wound (i.e., desiccation, maceration, trauma, edema, and infection). Systemic factors are not related to the wound itself. These factors take place throughout the body (i.e., age, venous insufficiency, poor oxygenation, obesity, diabetes, medications, and smoking and alcohol use). Wounds and pressure injuries causes stress and emotional challenges caused by pain, fear, disruption to activities of daily living, and an altered body image that can have a significant effect on an affected person's self-identity and mental well-being. There are several events that can interfere with wound healing and cause complications. Infection, hemorrhage, dehiscence and evisceration, and fistulas can increase the risk of death or generalized illness, increase healthcare costs, and prolong the need for healthcare interventions. The nursing role includes assessment and documentation, positioning, dressing care, drain care, suture and staple care, cleaning, debridement, administration

of growth factors and heat and cold therapy, wound care education and health promotion, and education of the patient to perform self-care at home. Other therapies that the nurse may be required to assist with include hyperbaric oxygen therapy and surgery. It is essential that nurses understand their role in wound care management to effectively implement interventions within their scope of practice.

8.4 Burn Injuries and Management

Burn injuries are both preventable and different from other wounds. Their assessment requires evaluation of the type of burn, its depth, and the amount of body surface area it covers. Management of burns is based on the type and degree of burn, and ranges from basic first aid to long-term inpatient care and surgeries requiring extensive support from a large interdisciplinary healthcare team. Due to the complexity of burns, there are a variety of complications related to them, including psychological trauma, respiratory dysfunction, sepsis, and potentially death. The healing process includes the rehabilitation phase, which can be extensive, lasting from weeks to years depending upon functional impairment and loss of ability. Nurses must prepare patients for realistic expectations in the healing process.

Key Terms

abrasion an area damaged by scraping
acute radiation syndrome (ARS) an acute illness related to full-body exposure to high levels of radiation
acute wound a wound that occurs suddenly and progresses through expected stages of healing
angiogenesis a process where capillaries grow across the wound, increasing blood supply and oxygen
arthrofibrosis scar tissue formed around a joint during the healing process, which limits range of motion
autolytic debridement the process of using occlusive dressings to enhance the body's own defense mechanisms to liquefy or soften necrotic tissue
avulsion a forcible tearing off of skin or another part of the body
Bates-Jensen Wound Assessment Tool (BWAT) an assessment tool to evaluate wound status and healing; it measures thirteen wound characteristics
blanching the temporary whitening or lightening of the skin around the wound site upon applying pressure
Braden Scale an assessment tool that evaluates the relative risk of a patient developing skin breakdown and pressure injuries. The scores can be used to tailor pressure injury prevention interventions to at-risk patients
burn an injury to the skin caused by thermal, electrical, chemical, or electromagnetic energy
burn shock a condition in which the circulatory system becomes dysfunctional and unable to compensate for the loss of blood, plasma, and fluid, even with aggressive fluid replacement
chemical burn a burn caused by the reaction of human skin to toxic chemicals
chronic wound a wound in which no healing occurs for at least three months
closed wound a wound that does not have a break in the skin and occurs under the skin's surface
cognition the mental processes that take place in the brain such as thinking, language, learning, memory, perception, and attention
collagen a whitish protein substance that adds flexible strength to the wound
contusion a region of injured tissue or skin in which blood capillaries have been ruptured
debridement the removal of slough or necrotic tissue and foreign material by various methods
decontamination the removal of residual chemical or radiological particles
desiccation unintentional wound or tissue dehydration
diabetic neuropathy nerve damage that causes numbing sensations
electrical burn a burn that occurs when an electrical source meets skin and transfers energy, damaging local tissue
enzymatic debridement the application of commercially prepared enzymes that accelerate the body's autolytic process (i.e., cell breakdown by enzymes contained in the affected tissue)
epibole rolled or curled-under wound edges that slow or stop the wound-healing process
epidermis the outermost layer of the skin consisting of epithelial cells
epithelialization the development of new epidermis; the growth of skin cells over skin and wound surface; healing to close a wound
erythema a change in skin color due to a change in blood flow
eschar dead tissue that forms over healthy skin and then, over time, falls off or sheds

excoriation the loss of the superficial layers of the skin, also known as a denuded area
exudate a liquid that is secreted from a wound
fistula an abnormal passage from one internal organ or vessel to another or an internal organ or vessel to the outside of the body
fluctuance a tense area of skin with a wave-like or boggy feeling upon palpation
fluid resuscitation the administration of IV fluids to ensure adequate intravascular fluid
foul purulent a thick yellow to green exudate with odor
fourth-degree burn a burn that involves everything from the epidermis down into bone or muscle
friction a force created by two surfaces rubbing against each other
frostbite a type of burn in which the water in tissues freeze and cause deep tissue injuries and necrosis
full-thickness (third-degree) burn a burn involving all of the epidermis, dermis, and some of the subcutaneous fat and deeper structures
granulation tissue delicate, new, reddish connective tissue and tiny blood vessels that bleed easily but provide the framework for scar tissue development
hematoma a localized collection of blood under the skin that may appear reddish blue with swelling
hemostasis the cessation of bleeding
hypoproteinemia abnormally low amounts of serum protein from the diet
hypovolemic shock a type of shock due to decreased fluid volume in blood vessels that impacts the blood flow and transport of oxygen to organs and tissues
incision a surgical cut made in skin or flesh
induration a thickened or hardened area
inhalation injury an injury caused by breathing in particulates, such as heat and smoke from fires, or chemical burning of upper airways
intentional wound a planned wound; the result of a treatment or therapy
laceration a deep cut or tear in the skin or flesh
liquefaction necrosis death of body tissues
localized wound healing factor a factor that affects wound healing directly (i.e., desiccation, maceration, trauma, pressure, excessive bleeding and edema, and infection)
maceration the softening of tissues caused by prolonged wetting or soaking
mechanical debridement the application of external physical force to remove debris or necrotic tissue
Montgomery strap a tie that attaches to an adhesive backing that holds a dressing in place
NPO nothing by mouth
open wound a break in the skin or mucous membranes, caused either intentionally or unintentionally
osteomyelitis a bone infection
palmar method a strategy for determining TBSA of small burns
Parkland burn formula a commonly used formula for determining the amount of fluid resuscitation needed for patients who have been burned
partial-thickness (second-degree) burn a burn involving the epidermis and some portion of the dermis
penetration a wound caused by objects that pierce the skin and lacerate or damage adjacent tissue
phagocytosis the movement of leukocytes and macrophages into the interstitial space to ingest bacteria and cellular debris
pressure injury a localized ischemic lesion of the skin and underlying tissue caused by external pressure that impairs blood and lymph flow
primary intention healing a type of healing in which the wound edges have been approximated with little to no tissue loss and show formation of nominal granulation tissue and scarring
puncture a wound made by a pointed object
purulent pus; tan to yellow exudate
Rule of Nines a strategy for determining TBSA of large burns
sanguineous relating to bloody exudate
secondary intention healing a type of healing in which extensive wounds that have significant tissue loss make approximating edges difficult or not a good option
serosanguineous relating to a mix of serous fluid and blood in exudate
serous relating to thin, watery, clear exudate

shear the sliding of one tissue layer over the other
skin grafting transplanting a piece of healthy skin from one area of the body to another
slough a nonviable layer of dead tissue that is a stringy, moist, and yellow, tan, gray, green, or brown
stable eschar an area of eschar on the skin that is adherent, dry, and intact without fluctuance
superficial (first-degree) burn a burn involving only the epidermis
superinfection a secondary infection that is unrelated to the original infection and results from opportunistic colonization after immunosuppression
Surgical Site Event Risk Assessment (SSERA) model an assessment tool to determine the relative risk of a patient developing a surgical site infection after a surgical procedure
systemic wound healing factor factors that occur throughout the body and are not related to the wound itself (e.g., age, venous insufficiency, poor oxygenation, obesity, diabetes, medications, and smoking or alcohol use)
tertiary intention healing delayed primary intention healing where the wound is left open for three to five days to allow edema or infection to resolve or to allow any exudate to drain
thermal burn a burn related to temperature
tissue necrosis tissue death
total body surface area (TBSA) percentage of the body's surface
trauma injury caused by a blunt or blow force
tunneling erosion in channels beneath intact skin surrounding a wound
ulcer an open sore caused by poor blood flow
undermining erosion beneath the skin's surface beyond visible edges
unintentional wound a wound from an unexpected trauma
Wagner Ulcer Classification System an assessment tool to describe severity of diabetic foot ulcers
wound an injury that causes a disruption of normal skin or tissue integrity
wound thickness the amount of skin breakdown, fat exposure, and bone and/or muscle involvement in a wound

Assessments

Review Questions

1. Identify an example of an intentional wound.
   a. bullet
   b. stab wound
   c. surgical incision
   d. fracture

2. The nurse recognizes that what factor does not put a patient at risk for pressure injury development?
   a. altered mental status
   b. loss of appetite
   c. advanced age
   d. weightlifting

3. Maceration can be defined as
   a. a loss of superficial layers of the skin.
   b. tissue that has been softened by prolonged wetting or soaking.
   c. tissue that has been hardened by pressure.
   d. tissue that has development of slough.

4. The nurse is assessing a patient with a deep red area of intact skin that does not blanch. As what stage of pressure injury is this classified?
   a. stage I injury
   b. deep tissue injury
   c. unstageable injury
   d. stage II injury

5. The nurse is educating a new graduate nurse on pressure injuries and knows that the new graduate nurse

understands the teaching when they say what?

a. "The difference in stage III and IV pressure injuries is the visibility of fascia, tendon, ligament, muscle, cartilage, and bone."
b. "Slough and eschar are present at every stage."
c. "If the area blanches, it is stage I."
d. "A diabetic ulcer is also called a deep-tissue pressure injury."

6. Identify the type of exudate from the wound shown.

(credit: "Selfinjury" by "Sumasla"/Wikimedia Commons, Public Domain)

a. sanguineous
b. purulent
c. foul purulent
d. serous

7. A patient is being assessed for risk for surgical complication using the SSERA model. The duration of the surgery is expected to be 180 minutes. The nurse recognizes that this surgical length automatically makes the patient what level of risk?

a. low risk
b. no risk
c. high risk
d. moderate risk

8. Identify the Wagner Ulcer Classification of the wound shown.

(credit: "Gangrene Foot 01", by "آرمین"/Wikimedia Commons, Public Domain)

a. grade 1
b. grade 2
c. grade 4
d. grade 5

9. When the skin surrounding the wound is spongy and saturated, how should it be described?

a. edematous
b. boggy
c. attached

d. macerated

10. What phase of the healing process do leukocytes move into the interstitial space to ingest bacteria and cellular debris?
a. hemostasis
b. inflammatory phase
c. proliferation phase
d. maturation phase

11. The nurse is explaining complications associated with wound healing to a new patient at the clinic. How should the nurse describe maceration?
a. occurs when hydration leads to cell death
b. occurs when there is trauma the wound
c. occurs when there is swelling that interrupts blood flow
d. occurs where the cells are overhydrated leading to skin softening and breakdown

12. What nursing intervention is appropriate when performing a dressing change?
a. administering pain medication prior to wound care when the patient states that wound care is painful
b. telling the patient that they just need to look at the wound
c. explaining to the patient that the smell from the wound is not that bad
d. encouraging the patient that they do not have to make any changes in their activities of daily living

13. What type of debridement promotes the body's own defense mechanisms?
a. enzymatic debridement
b. mechanical debridement
c. autolytic debridement
d. wet-to-dry debridement

14. A patient comes into the emergency room with a burn on their forearm from boiling water. It is red, painful, and blistered. The nurse correctly identifies this as what type of burn?
a. first degree
b. second degree
c. third degree
d. fourth degree

15. A farmer comes into the emergency room after being exposed to chemicals while fertilizing their crops. The nurse correctly recognizes what to be true about this type of burn?
a. The tissue injury ceased after the chemicals were removed.
b. The injury will require surgical treatment.
c. The chemicals may continue to impact the tissues after decontamination.
d. The nurse needs to look for an entry and exit point.

16. A patient is admitted to the burn unit after a severe burn. They weigh 143 lb (65 kg) and have a TBSA of 25 percent. Using the Parkland burn formula, how much fluid should the nurse expect the patient to receive over twenty-four hours?
a. 6,500 mL
b. 8,300 mL
c. 3,500 mL
d. 12,000 mL

17. The nurse expects the physician to order a consultation with what type of provider to prevent contractures in a patient with severe burns?
a. nutritionist

b. recreational therapist
c. physical therapist
d. respiratory therapist

Check Your Understanding Questions

1. Describe intentional and unintentional wounds.
2. Describe closed and open wounds.
3. Describe the difference between erythema in patients with lighter skin and patients with darker skin tones.
4. Describe the five types of exudate that may come from wounds.
5. Describe how the disruption of activities of daily living (ADLs) may have psychological effects on a patient.
6. Describe nursing interventions for a patient who has altered body image caused by a chronic wound.
7. Explain the difference between providing decontamination for a patient with chemical burns and a patient with radiation burns.

Reflection Questions

1. What information might you consider when assessing whether a patient is at risk of developing a pressure injury?
2. What information should you consider when preparing education for self-care at home?
3. Consider the issue of continuity of care and the various complications and complexities related to caring for patients who have been burned. Why do you think the recommendation is to transfer patients with serious burns to burn centers? How do you think the provided care might be different?

What Should the Nurse Do?

The nurse on an intensive care unit is caring for an 83-year-old female admitted for a urinary tract infection and sepsis. The patient has been in a nursing home following a cerebrovascular accident resulting in right-sided weakness and paresthesia. The patient appears to be malnourished with sunken skin over bony prominences. During the shift assessment, the nurse notes a reddened area of intact, nonblanchable skin on the sacral areas. The head of the bed is elevated because the patient is at risk of aspiration with feedings.

1. How should the nurse assess the skin?
2. What factors increase this patient's risk of skin breakdown?
3. What things can the nurse do to prevent further damage and promote healing?
4. You are caring for a patient who is recovering from a laparotomy surgery. The patient has been coughing all morning. The patient states that it "feels like something has come undone." Upon examination you see that a section of the surgical incision has come apart. What should you do?

A patient is brought to the emergency department by ambulance at 7 p.m., approximately an hour after a house fire. The patient has second- and third-degree burns on their left side, including the left side of their head, their left arm and leg, and left torso and back. The nurse and receiving physician agree that the TBSA of the patient's burn is 49.5 percent. The patient received 1,000 mL of lactated Ringer's in the ambulance. The patient weighs 141 lb (64 kg). Using the Parkland burn formula, answer the following question about what the nurse should do.

5. How much fluid and what type of fluid should the nurse give the patient in the first twenty-four hours?
6. How much more fluid and at what rate should the nurse give the patient over the next seven hours?

Competency-Based Assessments

1. Use the Braden Scale (https://openstax.org/r/77pessulcer) for predicting pressure sore risk to answer the following question.

   Scenario: Ms. Fischer has just been admitted for rehabilitation after a stroke. She is experiencing paralysis on

one side and has only begun rehab to walk again. The nurse performs her initial Braden assessment with the following findings:

a. Sensory perception: she responds to verbal commands but cannot always tell staff when she is hurting or needs to be turned.
b. Moisture: she sweats frequently and staff have to change her sheets regularly.
c. Activity: she is chairfast at this time due to paralysis related to the stroke.
d. Mobility: she is able to shift herself around in the bed or chair using unaffected arm and leg
e. Nutrition: her appetite is good and she regularly finishes her meals plus snacks her family brings her.
f. Friction and shear: she struggles with sliding down in the bed or chair and having difficulty righting herself; she is unable to lift her full weight when moving herself or being moved.

What is Ms. Fischer's Braden Score? What is her level of risk?

2. Describe key points the nurse would teach the patient about wound management at home.
3. You are seeing a patient in a physician's office one month after release from the hospital following a house fire in which the patient and one of their children were badly burned. They continue to experience psychological distress related to their burn and scarring and are worried about their child as well. Use the information about living with burn injury (https://openstax.org/r/77MSKTC) to identify two resources you might use to help them and provide links to the resources for your instructor.
4. Review the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 9

Activity Assessment and Management

FIGURE 9.1 Assessing functional ability and mobility is part of nursing care. (credit: modification of work "Naval Hospital Jacksonville Physical Therapy 210205-N-QA097-001" by Deidre Smith/Navy Medicine/Flickr, Public Domain)

CHAPTER OUTLINE

9.1 Assessing Functional Ability
9.2 Assessing Mobility
9.3 Transferring Patients
9.4 Positioning in Bed
9.5 Limited Movement Devices

INTRODUCTION Part of comprehensive nursing care involves assessing the movement of patients, whether they move independently or with assistance. Nursing interventions are based on maintaining as much independent movement as possible. This can be done by educating and providing demonstrations of various exercises. This chapter will discuss how to assess the functional ability and mobility of patients, how to safely transfer a patient, proper positioning in the bed, and frequently used mobility devices.

9.1 Assessing Functional Ability

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify tools used to determine functional ability assessments
- Develop nursing interventions related to performing ADLs
- Differentiate isotonic, isometric, and isokinetic exercises

Hospitalization and decreased functional ability contribute to an increased risk of patient complications. Specifically, immobility or decreased mobility often contribute to health issues such as pressure injuries, pneumonia, blood

clots, constipation, and physical deconditioning. These complications due to immobility and subsequent deconditioning can result in extended lengths of stay for patients (e.g. delay in discharge due to complications), increased costs related to hospitalization and treatment, and patient dissatisfaction with the quality of care. Therefore, assessment and management of functional ability are critical to prevent adverse effects and enhance patient recovery.

In the United States, approximately 35 percent of adults over the age of 65 report some difficulty in at least one activity of daily living (ADL), such as walking or climbing (Fuller-Thompson et al., 2023). Based on this statistic, it is critical that nurses assess functional and mobility status early to initiate ambulation routines and continue to reassess throughout the patient's care to prevent complications in a patient's recovery. Mobility assessments completed upon admission create a baseline for nurses to note improvements or setbacks in patients' progress. Healthcare facilities should have policies and standardized evaluations for patient assessment and evaluation. Collaboration and communication between the nurse and the interdisciplinary team are essential to creating a safe plan of care for the patient.

Determining Functional Status

The **functional status** is a measurement of a patient's ability to perform physical movements (e.g., walking, standing) and higher-level activities (e.g., activities of daily living, filling occupational and societal roles). An impairment or decline in functional status can impede daily routines, self-care, and autonomy. These impairments can be caused by disease (Figure 9.2), deconditioning, environmental changes, a shift in social supports, or advanced age.

FIGURE 9.2 This patient has rheumatoid arthritis and has developed contractures in their hands, making eating, dressing, and toileting difficult to perform independently. (credit: modification of work "RheumatoideArthritisAP.jpg" by Bernd Brägelmann/Wikimedia Commons, CC BY 3.0)

A functional status assessment should be performed using a standardized, validated assessment tool. Two commonly utilized tools are the Katz Index of Independence in Activities of Daily Living (Katz ADL Index) and the Lawton-Brody Instrumental Activities of Daily Living Scale (Lawton Scale for IADL). The Katz ADL Index awards points for independent activities such as bathing, dressing, toileting, transferring, continence, and feeding. The higher scores indicate increased independence with ADLs. The Lawton Scale for IADL assesses independent living skills that are more complex and include shopping, laundry, handling finances, and other tasks. This scale identifies how a person is functioning at that present time. Scores range from 0 (low function, dependent) to 8 (high function, independent) for women; 0 to 5 for men.

LINK TO LEARNING

The Katz Index of Independence in Activities of Daily Living (https://openstax.org/r/77KatzIndex) is helpful for assessing a patient's ability to live independently.

Assisting with ADLs

An **activity of daily living (ADL)** is a routine activity to care for oneself independently. Assessment of ADLs is often

used to determine a patient's needs, whether it is dependent support, a change in living arrangements, paid caregivers, or implementation of durable medical equipment. A disruption in independent ADLs can result in patient safety issues or poor quality of life. Therefore, routine ADL screening is essential for nurses to determine if patients can independently meet their self-care needs.

ADLs are classified as basic ADLs or instrumental ADLs (IADLs) (Table 9.1). A **basic ADL** is a basic need such as toileting, dressing, bathing, eating, and ambulating. An **instrumental ADL** is more complex and relates to activities that would keep a patient independent in the community, such as managing medications, preparing food, and managing household chores.

Examples of Activities of Daily Living (ADLs)	Examples of Instrumental Activities of Daily Living (IADLs)
Eating	Cooking
Toileting	Cleaning
Bathing	Maintaining finances
Dressing	Shopping
Transferring	Preparing meals
Grooming	Managing medications

TABLE 9.1 Examples of ADLs and IADLs

Preparing the Patient for Activities of Daily Living

In preparing patients for assistance with ADLs, nurses should focus on providing comfort, safety, and dignity, and promoting independence as much as possible. Nurses should always tell their patients when they are beginning a new task and inform them of all of the steps. All products and supplies should be set up prior to care, ideally with the patient's preferred products.

REAL RN STORIES

Remember to Support Independence with ADLs

Nurse: Lashonda, RN
Clinical setting: Large hospital system
Years in practice: 7
Facility location: Hartford, Connecticut

I walked into my patient's room to help assist them after bathing. The patient, an 87-year-old female named Wanda, already laid out her comb, deodorant, and lotion on the counter next to the sink. Wanda finished dressing and was buttoning her shirt. I saw that Wanda was struggling with the buttons because of arthritis, and I said "I can do that for you." I walked over to button the last two buttons before Wanda had a chance to respond. Then I said that I would bring over Wanda's supplies next to the sink. This time Wanda firmly said, "No dear. I will go over to the sink to comb my hair. I can do it . . . just like I could have finished buttoning my shirt." Horrified, I realized that I wasn't letting Wanda perform her ADLs and was interfering with her independence. I apologized and told Wanda that I'm here if she needs help but will wait for her to ask. Wanda was happy with that response. This story has stuck with me throughout my career, and I have since always asked my patients if they needed assistance with their ADLs.

If the patient can perform certain tasks, the nurse should allow them to and assist only when necessary. This supports patient autonomy and provides a way for the nurse to assess the patient's abilities, and prepares the patient for discharge.

Safety is paramount when assisting patients with their ADLs. The nurse should ensure they have the space necessary to assist with care, the patient is in a safe position, and the appropriate level of assistance is available. For example, if a nurse is performing a bed bath on an immobile patient, assistance from another clinician is necessary to ensure proper turning and repositioning.

Finally, the nurse should ensure that the patient's dignity is preserved during assistance with ADLs. Patients who

can no longer care for themselves or perform simple tasks may be apprehensive about accepting help, feel like a burden, or be embarrassed. Nurses can provide reassurance and privacy to patients by covering certain body parts during bed baths, closing doors or curtains prior to procedures, actively listening to patients' requests and needs, and acting professionally and respectfully. In addition, the nurse can ask the patient their preferences for activities while aiding. An example of this is a nurse asking the patient if they want bath soap/body wash applied in their bath water or applied to a small towel instead. This allows the patient to retain some control over the activity and lessen the feeling of helplessness.

CULTURAL CONTEXT

Generational Considerations When Assessing IADLs

Instrumental ADLs include activities that would keep a patient independent in the community. A 2017 study that examined IADL questionnaires used for older adults were more accurate for women over 65 than for men over 65 years of age (Sheehan & Tucker-Drob, 2019). Older men were more likely to state they could not perform certain IADL activities, such as cooking and housework, because they had not previously performed these tasks, not because of a physical restriction. Researchers suggested methods to address these biases, including measuring items that are gender neutral such as using the telephone and taking medication. If a patient scores low in a particular section, the nurse can ask additional patient history questions to obtain a more accurate assessment of IADLs in older generations. Additional questions to ask may include the following:

- Were you ever in charge of grocery shopping?
- Did you always prepare your own meals?
- Who always did the house work?
- Were you ever in charge of the household finances?

Preparing the Environment for Activities of Daily Living

Similar to preparing the patient, the environment of care should be safe and free of obstructions prior to ADL activities. The environment of care should be checked for any obstructions or potential fall risks (e.g., unsecured tubing, wires, equipment, wet floors, IV poles, linen carts) prior to patient ambulation. When a patient is getting dressed, toileting, or showering, the nurse should have all supplies available and within reach, and, depending on the patient's functionality, avoid leaving them alone during ADL activity. Feeding/eating is another example where patients may need a tray set up or assistance with feeding. The nurse should be aware of the patient's dietary requirements and physical capacity to eat meals so that they can adequately set up the environment for the patient.

Exercise

Performing ADL activities can be improved with exercises provided by an occupational or physical therapist. Exercise programs focus on functional exercise to promote mobility, ambulation, and functionality. These exercises do not require special equipment and are tailored to the patient's needs. In a medical setting, **therapeutic exercise** uses intentional movement to develop strength and endurance and to increase range of motion and flexibility. These exercises use simple techniques to build on weakened areas of the body that prevent patients from performing ADLs (Figure 9.3).

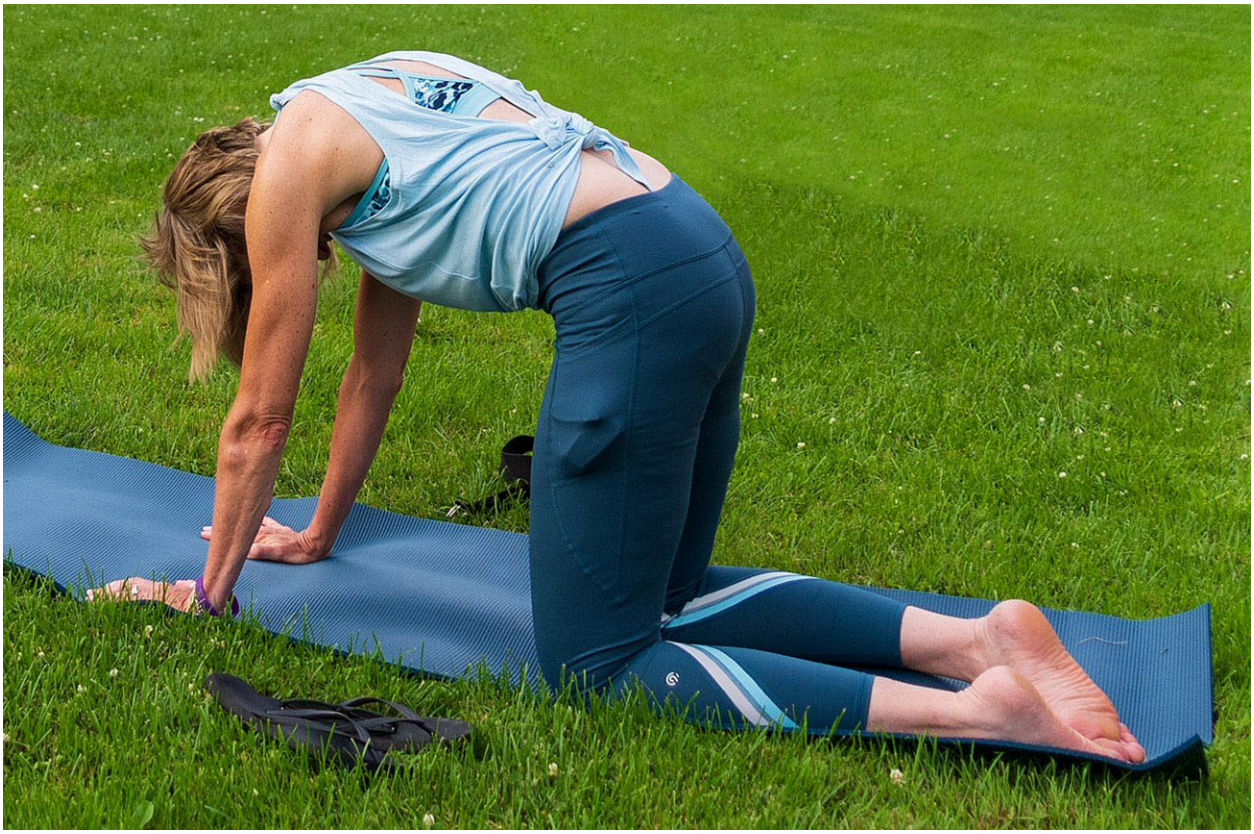


FIGURE 9.3 The cat-cow stretch is a therapeutic exercise that stretches the spine and hips with a series of movements that alternate between arching the back and hollowing it out. (credit: "Yoga at Your Park" by Mary O'Neill/Wikimedia Commons, Public Domain)

Types of Exercises

Building and maintaining muscles requires **strength exercise**, which focuses on increasing the maximum amount of force a muscle can exert. As older adults age, muscle mass decreases, especially in older adults who do not regularly exercise. Exercises are designed using body weight, resistance bands, and weights. The difficulty of the exercise can be modified as the patient begins to show progress. Examples of upper body strength exercises include shoulder presses, ball squeeze, front or lateral shoulder raises, and rowing with a band. Examples of lower body exercises include lunges, squats (Figure 9.4), bridges, and hip hinges.

FIGURE 9.4 A kettlebell squat is an example of a strength exercise. (credit: modification of work "Fit to Fight" by Capt. Zach Anderson/ United States Air Force, Public Domain)

Exercises addressing range of motion (ROM), which is how much a person can move or stretch parts of the body, aim to increase joint flexibility and mobility. A movement called **stretching** lengthens the muscles and is also complementary to ROM exercises to reduce muscle tension. However, patients must have proper form during these exercises and start gradually. Improper form can lead to injury and muscle strain. ROM exercises include flexion and extension of the hip, elbow, shoulder, and knee.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety: Fall Risk Prevention

Definition: Reduce risk for falls and patient harm.

Knowledge: The nurse will utilize the recommendations of the Agency for Healthcare Research and Quality (AHRQ) for best practices in fall prevention for all patients, regardless of fall status. The nurse will:

1. Maintain universal fall precautions:
    a. Familiarize the patient with the environment.
    b. Have the patient demonstrate call bell use and ensure it is functioning correctly.
    c. Maintain the call bell within reach.
    d. Keep the patient's personal possessions within safe reach.
    e. Have sturdy handrails in patient's bathroom, room, and hallway.
    f. Place the hospital bed in a low position with the brakes locked.
    g. Keep the wheelchair wheel locked.
    h. Provide the patient with nonslip, comfortable, well-fitting footwear.
    i. Use night lights or supplemental lighting.

   j. Keep floor surfaces dry, clean, and uncluttered.
2. Assess fall precautions every hour, including mentally reviewing fall prevention factors with the patient. This includes the "five Ps" which are:
   a. Pain—assess the patient's pain level and provide interventions, if needed.
   b. Personal needs—offer help using the toilet, offer food or drink, and empty commodes/urinals.
   c. Position—help the patient get into a comfortable position or turn patients who are immobile to maintain skin integrity.
   d. Placement—make sure the patient's essential needs (such as call bell, phone, reading material, toileting equipment) are within easy reach.
   e. Prevent falls—ask the patient/family to ring the call bell if the patient needs to get out of bed.
3. Have a "closing script" at the end of each round that states, "If you need a nurse before I come back, use the call bell to request help."

Attitude: The nurse will respect their individual role in fall prevention by adhering to safe, evidence-based practice standards.

Balance is another important aspect of functioning. A **balance exercise** is a movement to reduce the risk of falls among patients by focusing on body alignment and control, and include exercises such as single-leg balance (with or without an assistive device), high-knee marching, and heel raises.

Isometric Exercise

An **isometric exercise** is a movement related to the contractions of specific muscles or groups of muscles and then their release. These exercises do not require much movement but are beneficial in maintaining and building strength (Figure 9.5). A patient uses their body to tighten certain muscles for five to ten seconds, then releases. These exercises can also improve stabilization, which is beneficial for the joints and the core muscles of the body, such as the posterior chain and abdomen. Other benefits of isometric exercises have been noted, including enhancing mindfulness—because a patient is focused on that one area of the body for each exercise—and reducing arthritic pain with isolated movements.

FIGURE 9.5 This person is performing a plank exercise, which is an example of an isometric exercise, where this position is held for a period of time. (credit: modification of work "130110-F-XM103-005.JPG" by Don Lindsey/Joint Base San Antonio, Public Domain)

Isotonic Exercise

An **isotonic exercise** is a movement that requires muscles to resist weight over a range of motion. This causes a change in the lengthening or shortening of the muscle. Isotonic exercises require both concentric (a movement that increases the muscle tension then remains stable once the muscle shortens) and eccentric muscle contractions (a movement that lengthens the muscle as the resistance becomes greater than the force the muscle is producing). Examples of these types of exercises include pushups, squats, bicep curls, and lunges (Figure 9.6). For patients who

are focusing on improving ADLs, these exercises can be incorporated with specific ADLs in mind. For example, if a patient is having difficulty getting up from a chair, they can perform slow bodyweight squats to strengthen their lower body.

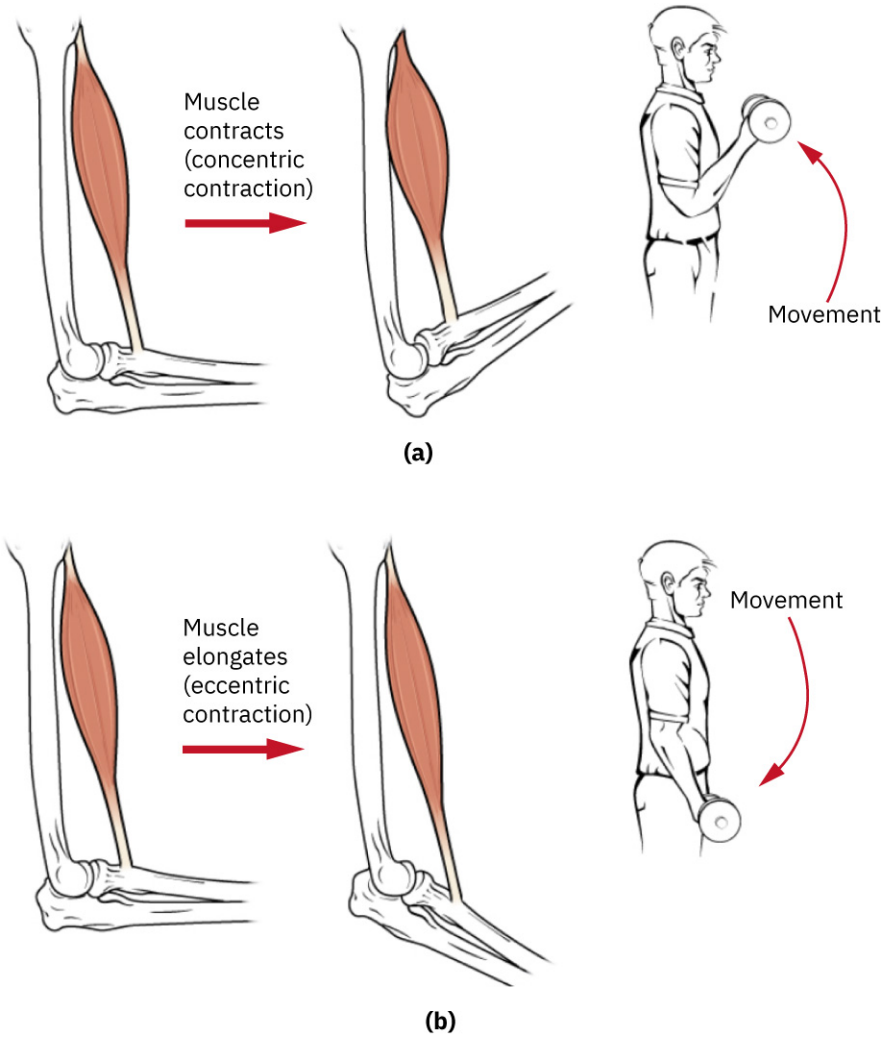


FIGURE 9.6 A bicep curl is an isotonic exercise where there are both concentric and eccentric contractions of the muscle. (a) Concentric contractions occur as the weight is lifted. (b) Eccentric contractions occur as the weight is returned to rest. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Isokinetic Exercise

As mentioned previously, exercises can be done with resistance bands (Figure 9.7). An **isokinetic exercise** is a resistance-based exercise that provides variable resistance to a movement. In these exercises, the speed of the movement is constant, but the resistance varies. Isokinetic exercises may require special equipment and are often used by physical and occupational therapists for rehabilitation and recovery. However, resistance bands can also be used to perform these exercises.

FIGURE 9.7 This person is using a resistance band to vary the resistance during lateral raises. (credit: modification of work "Girl doing lateral raises with bands" by Tyler Read/Flickr, CC BY 2.0)

Aerobic Exercise

An **aerobic exercise** is any cardiovascular activity that increases a patient's heart rate and respiration rate. Examples include walking, biking, rowing, jumping rope, climbing stairs, and hiking (Figure 9.8). Low-intensity aerobic exercises include marching in place, sit-to-stand chair transfers, and going up and down a step. Aerobic exercises benefit circulatory health by improving the capacities of the heart and lungs. The American Heart Association recommends a minimum of thirty minutes of cardiovascular exercise five to seven days per week (Piercy & Toriano, 2018). Patients who are gradually working on increasing ADLs may start with a reduced amount initially, but they should aim to increase their activity time to thirty minutes if they are able to do so. Every aerobic exercise should include a warm-up and cooldown. This decreases the risk of joint injury and increases blood flow to the muscles. The cooldown can include exercises to lower the heart rate and stretching.

FIGURE 9.8 Stationary bikes, elliptical machines, and treadmills are examples of machines that can be used for cardiovascular/aerobic exercise. (credit: U.S. Department of Defense, Public Domain)

Positive Effects of Exercise on the Body

Regular physical activity can positively impact a person's physical, emotional, and mental well-being. Key benefits of exercise include preventing bone loss among older adults, relieving pain for certain conditions, helping prevent chronic disease, boosting immunity, and improving mood. In addition, a combination of strength training, aerobic activities, and balance and mobility exercises can reduce the risk of falls, improve functional activities (ADLs), manage weight, and promote sleep. Exercise can also promote social interactions and prevent isolation if done in a group, which significantly benefits physical and mental health.

Patient Education about Importance of Activity

Nurses are poised to provide tips and education to patients on the importance of regular activity. Exercises and exercising do not have to be complicated, and some simple, safe exercises can provide numerous benefits. These exercises can range from patients performing simple body-weight range-of-motion exercises, including isotonic and isometric exercises in a chair to walking in their neighborhood with a group of friends. Nurses should utilize their interprofessional team and work with occupational and physical therapy to create appropriate exercises for their patients. Improving and maintaining a healthy physical lifestyle can enhance a patient's ability to continue with ADLs, thus promoting autonomy and independence.

PATIENT CONVERSATIONS

What If Your Patient Appears Anxious about Returning to Previous Functional Status After Surgery?

Scenario: Cain Johnson is a registered nurse working in an orthopedic unit of a hospital in Kansas City, Kansas. He has been a nurse for four years, and at the hospital for two. Cain is caring for James, a 75-year-old retired landscaper who just had knee replacement surgery and is worried about returning to running. James has completed

seven marathons and numerous half-marathons.

Patient: I just worry about my recovery. Getting this surgery was such as hard decision, but I was having a lot of knee pain in my right knee.

Nurse: I understand that you are worried. What specifically worries you?

Patient: I'm worried that I will not be able to run again. I have been doing it all my life and it gives me such a mental release. I wasn't going to get the surgery because of the possibility of not running again. I know that sounds silly, but this is the best way for me to relax and de-stress. I feel that if I'm not active, then I'll just spend my days watching TV, eating, and getting depressed. After my wife died last year, I really don't have anyone to spend time with.

Nurse: That doesn't sound silly at all. It seems that running was more than just a way to keep in good physical health, but also helped mentally. That is important. It may take you some time to recover from your surgery but with physical therapy and easing back into your daily tasks, you may be able to run again. Let's say hypothetically, you were not able to run. What could you do instead?

Patient: Well, I would still want to be active. There is a group in my neighborhood that walks every morning at 7:00 a.m. I usually see them when I'm running. They're all very friendly people but I haven't gotten to know them. They seem to have a great time on their walks . . . they're always laughing and talking.

Nurse: That sounds like a great plan after you recover a bit. Maybe you can join their walking group to see how that feels. Then, if you're up for it, you can start running again. But if you aren't, then you can stick with the group.

Patient: That's not a bad idea. Walking could be just as good as running, and maybe I'll make a friend or two in the neighborhood.

9.2 Assessing Mobility

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify key factors affecting mobility
- Describe techniques for assessing range of motion
- Recognize the effects of immobility on major body systems

Impairments in mobility impact a patient's community, health, and access to care. The Centers for Disease Control and Prevention (CDC) states that 12.1 percent of all adults in the United States have some type of mobility disability (Figure 9.9) (Centers for Disease Control and Prevention, 2023). Mobility disability is categorized as a serious difficulty in walking or climbing stairs. Imagine the difficulty of daily activities if walking and climbing stairs are an obstacle to overcome. Other types of disabilities include cognitive, independent living, hearing, vision, and self-care.

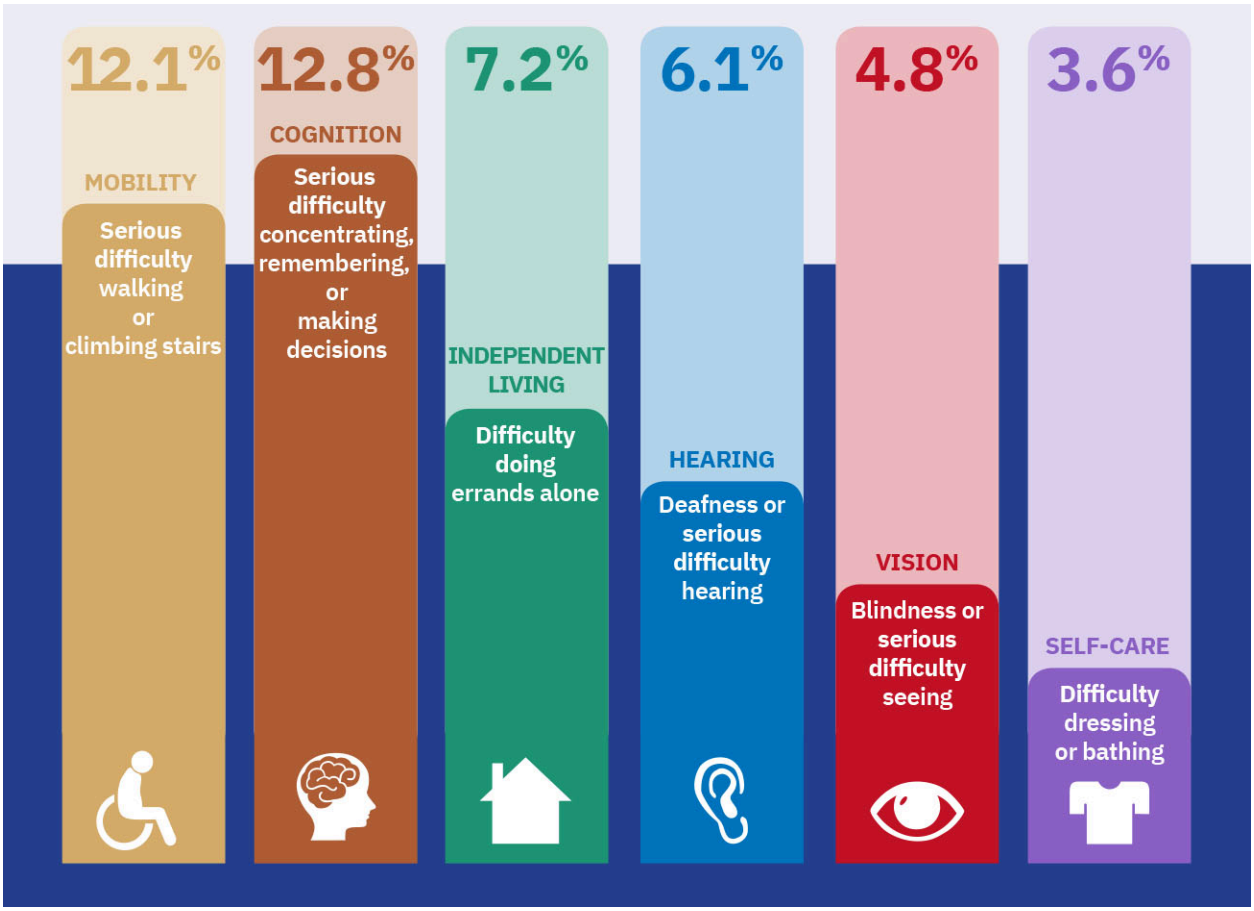


FIGURE 9.9 This infographic shows 2021 CDC statistics on the leading disabilities among adults in the United States. (data source: Center for Disease Control; attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

As a nurse, it is important to understand the importance of mobility, how internal and external factors can affect patient mobility, and how immobility affects the body. Proper understanding and assessment of a patient's mobility can help guide the nurse's plan of care and shape realistic outcome goals in treatment.

Factors Affecting Mobility

A person's **mobility** is the ability of a patient to change and control their body position. Physical mobility requires sufficient muscle strength and energy, along with adequate skeletal stability, joint function, and neuromuscular synchronization. Anything that disrupts this integrated process can lead to impaired mobility or immobility. Mobility exists on a continuum ranging from no impairment (the patient can make major and frequent changes in position without assistance) to being completely immobile (the patient is unable to make even slight changes in body or extremity position without assistance). Factors that affect a patient's mobility status can be internal or external. Internal factors can include chronic disease, congenital abnormalities, fatigue, or stress, and external factors include the environment around the patient.

LIFE-STAGE CONTEXT

Mobility Is Key to Independence in Aging

Factors that affect mobility as a person ages, such as chronic disease, and changes in gait, balance, and strength can increase the number and severity of falls. These factors can also lead to the inability to perform ADLs independently or spend time with friends and family. Older adults who experience a loss in mobility

- are less likely to remain living at home;
- have higher rates of disease, disability, hospitalization, and death; and

- have poorer quality of life.

Researchers from the National Institute for Aging (NIA) are identifying risk factors for physical disability to prevent or reverse the loss of mobility and provide healthcare clinicians with interventions to improve physical function following hospitalization. Three current studies funded by the NIA are

- home improvements to help older adults remain independent,
- physical activity to prevent major mobility disability, and
- a reduction of sedentary behavior, such as sitting.

The goals are to enable older adults to age in place and remain as independent as possible to avoid costly institutional care.

Internal Factors

An **internal factor** that affects mobility is a factor that influences the patient from within, such as a physiological, sociocultural, psychological, or spiritual factor that is specific to each individual. Examples include hearing and visual function, frequent falls due to balance issues, chronic disease, personal attitude toward self-care, and mental health. These factors can vary in the degree in which they affect each patient. One patient may be mildly affected, only requiring minor alterations to lifestyle, while another patient may be so affected they require total care to function.

Congenital Abnormalities

A patient can suffer from impaired mobility due to a **congenital abnormality**. Congenital abnormalities are impairments of body function or structure present at birth (Table 9.2).

Congenital Abnormality	Effects on Mobility
Cerebral palsy	• Poor motor coordination • Muscle stiffness and weakness • Involuntary movements
Club foot	• Restriction of normal foot movement • Prevention of proper weight distribution on feet
Congenital heart defects	• Low tolerance for activity • Increased fatigue
Muscular dystrophy	• Muscle weakness • Possible deformity
Spina bifida	• Leg weakness • Paralysis

TABLE 9.2 **Congenital Abnormalities and Their Effect on Mobility**

Muscle, Bone, and Joint Development

Joint structure, connective tissue, and changes in elasticity and flexibility of ligaments and tendons play a role in impaired mobility. As a patient ages, muscle is replaced with **fibrous connective tissue** and **adipose tissue**. Fibrous connective tissue protects, supports, and holds bones, muscles, organs, and other tissues within the body in place. Adipose tissue is body fat. Loss of bone mass begins to occur among individuals after the age of 40 (Campbell, 2021). Osteoporosis is an age-related disorder that causes the gradual loss of bone density and strength. When the thoracic vertebrae are affected, there can be a gradual collapse of the vertebrae (Figure 9.10). This results in kyphosis, an excessive curvature of the thoracic region. Other factors that can impact mobility include excessive

adipose bulk, which can impede range of motion (ROM); a lack of functional activities or exercises to promote flexibility and balance; and injury to muscle, joints, or connective tissues (Table 9.3).

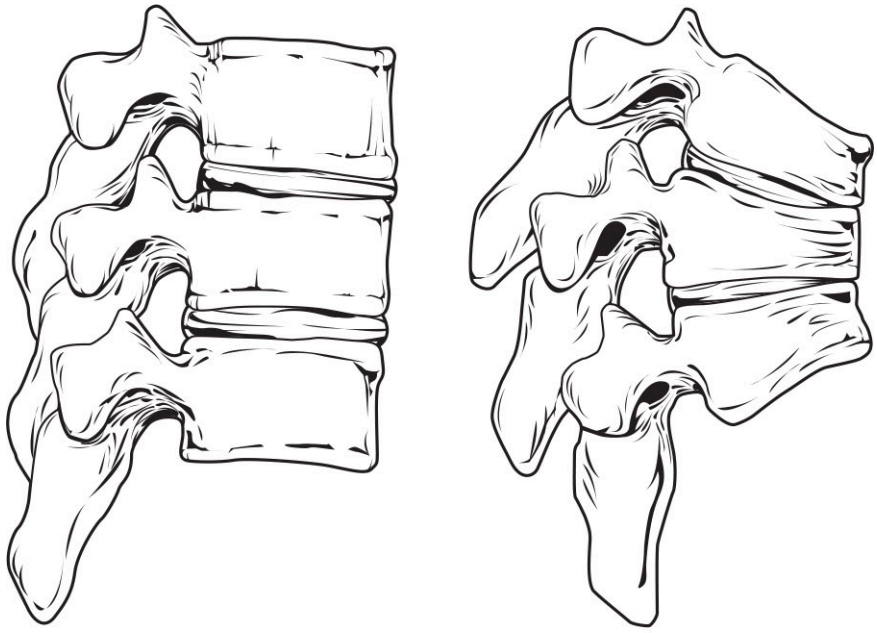


FIGURE 9.10 Osteoporosis, a progressive loss of bone density, is a factor in the deterioration of bones, muscle weakness, and changes in body composition in older adults. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Muscle, Bone, Joint Disorders	Effects on Mobility
Osteoporosis	Progressive bone loss leads to decrease in bone strength.
Muscle loss	Aging results in loss muscle mass.
Increased fibrous connective tissue	Fibrous connective tissues protects, supports, and holds bones, muscles, organs, and other tissues. Aging results in fibrous connective tissue replacing muscle mass.
Increased adipose tissue	Body fat begins to replace muscle mass in aging.

TABLE 9.3 Disorders That Affect Mobility

Fatigue and Stress

Stress can lead to fatigue, which can impact daily activities. This fatigue can be due to poor sleep quality, increased anxiety, and the effects of an existing disability. Individuals with disabilities are at a greater risk of experiencing fatigue than the general population, with this risk increasing with age. A person's well-being may be impacted by physical fatigue, psychological or emotional fatigue, and mental fatigue. Specifically, some disorders that can cause these types of fatigue include multiple sclerosis, muscular dystrophy, post-polio syndrome, and spinal cord injury. Fatigue can also occur by physical or emotional stress from comorbidities, medication side effects, poor diet, inactivity, or a substandard environment.

External Factors

An **external factor** can also cause mobility issues. External factors are factors that surround the patient that effect mobility, such as climate, terrain, housing design, neighborhood safety, local laws, social attitudes, and support. The U.S. Department of Health and Human Services states that social determinants of health (SDOH) impact health outcomes, including mobility (U.S. Department of Health and Human Services & Office of Disease Prevention and

Health Promotion, n.d.). A social determinant of health (SDOH) is a socioeconomic factor such as poverty, employment, and education that have the largest impact on health outcomes, mobility, education, and environmental conditions. Individuals with health-related social needs may lack affordable housing, access to healthy foods, connections with social services, or adequate transportation. For example, a patient who lives on a street without sidewalks or with sidewalks that have been destroyed by tree roots and not maintained will not have the same access to walk as someone who lives on a street with maintained sidewalks. In assessing patients, nurses should ask questions about the patient's social situations, their support systems, and access to resources that contribute to a healthy lifestyle.

CULTURAL CONTEXT

Culturally and Linguistically Appropriate Services (CLAS)

Health inequities have been identified as a barrier to access health care for many. Two factors are culture and language. Often, information may be difficult to understand based on language, literacy level, or culture relevance. The U.S. Health and Human Services developed CLAS to help eliminate health inequities by tailoring services to an individual's culture and language preference. Specifically, CLAS takes into account patient's cultural health beliefs, preferred languages, health literacy levels, and communication needs (HHS, n.d.). Initiatives started by public health departments, hospitals, and ambulatory care centers across the United States include

- training staff in CLAS;
- recruiting a workforce representative of the community served;
- offering comprehensive language assistance services;
- requiring interpreters' skills be certified or assessed;
- using advanced technology for interpretation services;
- improving the collection of race, ethnicity, and language data; and
- incorporating CLAS into mission, vision, and strategic plans.

Assessing Range of Motion

A person's **range of motion (ROM)** is the extent to which a part of the body can be moved around a joint or a fixed point. Assessing ROM includes observing the capability and total movement of the joint. ROM is assessed during active ROM, active-assisted ROM, and passive ROM.

A movement called **active ROM** is ROM that is done independently by the patient. Patients who can contract, control, and coordinate movement around a joint are able to participate in active ROM exercises. An example of how to perform an active ROM assessment would be for the nurse to ask the patient to mimic their movements. The nurse will then demonstrate flexion, extension, hyperextension, or rotation while the patient tries to duplicate the same motions. Things to assess during active ROM include

- the patient's willingness to move;
- any onset of pain, including where or when the pain occurs;
- if any movement intensifies pain;
- any visible restrictions to movement, and if there is a pattern; and
- the quality, pattern, and rhythm of the movement.

A movement called **active-assisted ROM** is ROM performed with partial assistance from an external force; the patient is able to perform ROM but may need additional assistance when they encounter pain or weakness. To assess this, the nurse may ask the patient to mimic their movements, similar to active ROM assessment. When the patient reaches a point of difficulty, the nurse can assist with completion of the movement. Things to assess for during active-assisted ROM include

- any onset of pain; including where or when the pain occurs;
- where the restrictions to movement are, and if there is a pattern;
- if assisted ROM movement intensifies pain; and
- how the patient feels after active-assisted ROM is complete.

A motion called **passive range of motion ROM** is movement to a joint or body part solely by another person or by a passive-motion machine. When passive range of motion is applied, the joint of an individual receiving exercise is completely relaxed while the outside force moves the body part while they are lying in bed. Things the nurse can assess while performing passive ROM include

- any onset of pain, including where or when the pain occurs;
- any restrictions to movement, and if there is a pattern;
- if movement intensifies pain; and
- how the patient feels after passive ROM is complete.

With this assessment information, nurses can collaborate with the provider and physical therapists to determine why any ROM deficits are occurring and create therapeutic interventions to support optimal ROM goals (Physiopedia, n.d.).

Posture and Gait

A person's **posture** and the postural system is a fundamental mechanism to ensure balance against gravity, align the body, and assist in external environmental perception and action. Posture is not simply the act of "sitting up straight" but rather a central, dynamic process that relates to other physical processes such as sensory detection and coordination with the nervous system. Data from posture assessment can contribute to how a person performs ADLs, assessing musculoskeletal injuries, determining effectiveness of physical or occupational therapy interventions, and providing injury prevention information. A neutral posture is when a person's upper trunk and head are at zero degrees in relation to the vertebral column (Figure 9.11). The nurse's assessment will include how the patient's posture compares to a neutral posture. Nurses should observe if the patient is erect or slumped. If the patient's posture deviates from a neutral position this could be due to deficiencies in postural control and postural orientation and can lead to damage and misalignment of vertebrae. Posture has a direct effect on the movements during gait.

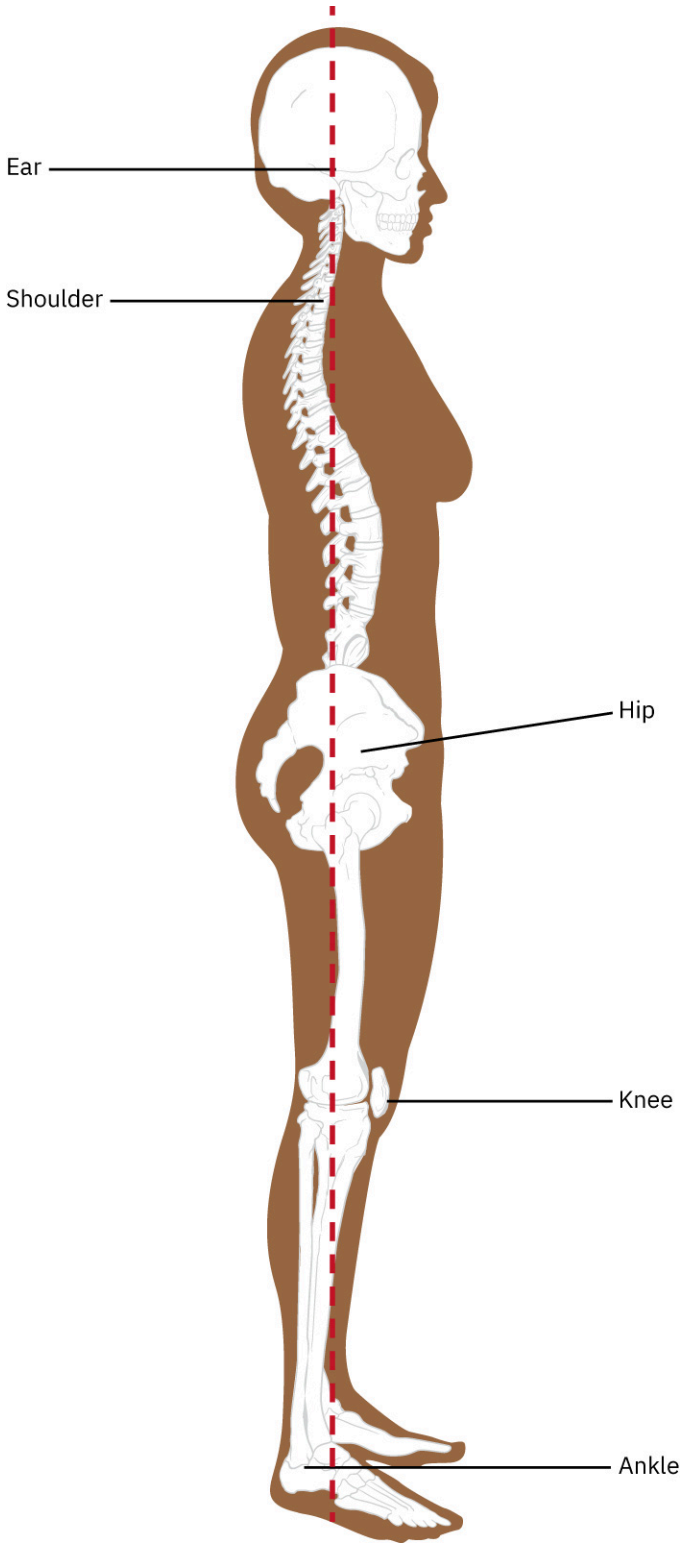


FIGURE 9.11 A neutral spine posture, that aligns the body's center of gravity, reduces stress on joints and ligaments. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

The body's **gait** is defined as a manner of walking or moving on foot. A person has a gait pattern, which is a series of rhythmical, alternating movements of the trunk and the limbs that results in a forward progression (Figure 9.12). The center of gravity, approximately anterior to the second sacral vertebrae (but changes as a person's anatomical position changes), is the point around where the force of gravity acts. Generally, a person's gait consists of a stance phase and a swing phase. In these phases, different body positions help to propel a person forward. Any

pathological issue can affect this gait pattern, leading to abnormal gait patterns. Examples include joint deformities, muscle weakness, loss of motor function, and pain. Age and pregnancy can also affect gait as increased age is associated with declines in walking speeds and changes in centers of gravity.

Nurses assess gait by observing the patient's stance phase and swing phase. The patient will walk across the room in different ways. First, the nurse observes patients on their toes, on their heels, and then heel to toe. In observing the gait, the nurse will take note of the patient's posture, center of gravity, and arm and leg movements. The patient's posture should be neutral, with slight swaying in the standing position. A patient's gait should be smooth and rhythmic, with their arms swinging at the sides.

FIGURE 9.12 A compilation of the phases of a normal gait cycle; movement should be fluid and smooth. (credit: modfication of work "Walking_gait_cycle.png" by "Ducky2315"/Wikimedia Commons, CC BY 3.0)

Coordination and Balance

As mentioned previously, a person's center of gravity plays a role in gait and posture but also affects coordination and balance. The force of gravity is generally downward; therefore, the body needs to adjust to the force of gravity while moving to promote stability.

A person's **coordination** is the organization of different elements of the complex body, including muscular, skeletal, and sensory functions, to enable the elements to work together effectively. The nurse evaluates coordination by having the patient rapidly touch each finger with the thumb, rapidly pat the hand on the thigh, and tap the foot on the floor (or against your hand, if the patient is supine). Repeat the sequence on the opposite limb. Normally, the movements would be coordinated. If the patient is unable to perform these movements, it may indicate disease of the upper motor neurons or cerebellum.

The body's **balance** is defined as a state of equilibrium. When a person's center of gravity falls outside its base of support (a stance with two feet evenly stable on the ground), they can become unstable. Proper coordination and balance are essential for gait stability and posture alignment. The Romberg test is used to test balance and is also used as a test for driving under the influence of an intoxicant. Ask the patient to stand with their feet together and eyes closed. Stand nearby and be prepared to assist if the patient begins to fall. It is expected that the patient will maintain balance and stand erect. A positive Romberg test occurs if the patient sways or is unable to maintain balance. The Romberg test is also a test of the body's proprioception, which requires healthy functioning of the spinal cord.

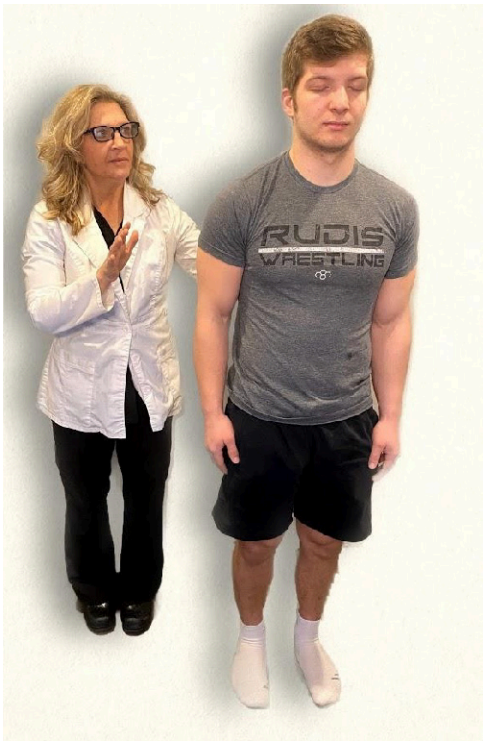


FIGURE 9.13 A nurse stands behind a patient during a Romberg test to make sure the patient does not fall. (credit: "Neuro Exam Image 9.png" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

A sense called **proprioception** is the body's ability to sense movement, action, and location of parts of the body. The sensations come from sensory receptors in the muscle, joints, and central nervous system signals to motor output. These sensory signals help patients perceive limb movements and positions, force, heaviness, and stiffness, and they help locate external objects relative to the body. A person's **vestibular function** is their body's ability to compensate in response to self and external forces and keep balance. If the vestibular system has any damage, it can affect balance, control of eye movements while the head is moving, and a sense of orientation to space. Finally, visual perception is a person's ability to see and interpret the surrounding environment.

LIFE-STAGE CONTEXT

Balance and Coordination: The Aging Process

As adults age, balance and coordination become compromised, which can lead to falls and injuries. Common issues among older adults include

- impaired vision,
- impaired gait due to changes in posture and loss of muscle mass,
- slower reaction time,
- dizziness or lightheadedness caused by medications or low blood pressure, and
- environmental hazards.

Tai chi is an exercise that is gentle and works on strength, flexibility, and balance.

Strength

Posture, gait, coordination, and balance are all affected by **strength**, which is the quality or state of being strong. Strength is foundational for the body to dynamically adjust and compensate to achieve balance and stability, coordinate parts of the torso and limbs, enhance posture, and correct gait.

Adults begins to lose muscle mass after age 40 with up to an 8 percent decline in muscle mass per decade (Cleveland Clinic, 2022). Muscle mass declines because of a reduction in muscle fibers and fiber size. In addition, the ability of muscles to repair damage also decreases. This process occurs as someone ages because of

fluctuations in hormones, including estrogen, testosterone, dehydroepiandrosterone (DHEA), growth hormone, and insulin-like growth factor. Assessment of strength is important to establish a baseline for intervention evaluations.

Muscle strength should be equal bilaterally, and the patient should be able to fully resist an opposing force. Muscle strength varies among people depending on their activity level, genetic predisposition, lifestyle, and history. A common method of evaluating muscle strength is the Medical Research Council Manual Muscle Testing scale (Table 9.4).

Stage	Description
0	No muscle contraction
1	Trace muscle contraction, such as a twitch
2	Active movement only when gravity eliminated
3	Active movement against gravity but not against resistance
4	Active movement against gravity and some resistance
5	Active movement against gravity and examiner's full resistance

TABLE 9.4 Medical Research Council Manual Muscle Testing Scale

This method involves testing key muscles from the upper and lower extremities against gravity and the examiner's resistance and grading the patient's strength on a scale of 0 to 5. For example, to assess upper extremity strength, first begin by assessing bilateral hand grip strength (Figure 9.14). Extend your index and second fingers on each hand toward the patient and ask them to squeeze them as tightly as possible. Then, ask the patient to extend their arms with their palms up. As you provide resistance on their forearms, ask the patient to pull their arms toward them. Finally, ask the patient to place their palms against yours and press while you provide resistance.

FIGURE 9.14 These are images of a nurse assessing upper extremity strength. (credit: "Neuro Exam image 38.png," "Neuro Exam image 41.png," and "Neuro Exam image 39.jpg" by Meredith Pomietlo/Chippewa Valley Technical College, CCBY 4.0)

UNFOLDING CASE STUDY

Unfolding Case Study #2: Part 4

Refer back to Chapter 7 Hygiene for Unfolding Case Study Parts 1 to 3 to review the patient data. The nurse is providing care to a 71-year-old male patient in a nursing home setting. The patient is a new resident, having only

been in the facility for one month. The patient's daughter, Alicia, was previously upset by finding her father incontinent. After meeting with the patient's daughter, a staff meeting was held to reiterate the importance of frequently toileting patients and ensuring they are clean and dry at all times.

Past Medical History	Patient's medical history includes COPD, GERD, hypertension, hyperlipidemia, and myocardial infarction with stents placed fifteen years ago. **Family history:** Patient has four adult children, but only one who lives in town. When asked about his children, the patient states, "Only one of my kids, my Alicia, talks to me. The rest live too far away and never call or visit." **Social history**: Previous occupation as a farmer. Recently sold the farm to a developer when he moved into the nursing home. Patient states, "I was forced to sell my home and farm because it wasn't making money anymore." **Current medications:** • lisinopril (Zestril) 10 mg daily • atorvastatin (Lipitor) 20 mg daily • hydrochlorothiazide (Hydrodiuril) 50 mg daily
Nursing Notes	**1200:** Assisted patient to bathroom. While ambulating, the patient stated, "I'm really having a hard time walking these days. Even with help, it's just too much work. Can't you just put one of those catheter things in me, so I don't have to get up?" **1230:** Focused musculoskeletal assessment performed. Patient reports bilateral hip pain that is 4/10 at rest and 6/10 with ambulation. Slight back kyphosis noted, and patient reports being unable to stand up completely straight. Shuffling gait with ambulation. Bilateral leg muscle strength rated 3/5.

1. Recognize cues: Which findings are most pertinent to the patient's functional status?
2. Analyze cues: What further information should the nurse gather to evaluate factors (internal and external) that may be affecting the patient's mobility?
3. Prioritize hypotheses: What are the priorities of care for the patient at this time?

Effects of Immobility on Major Body Systems

Immobility can pose a significant problem for all major body systems. Prolonged immobilization can affect every organ system and result in complications, including increased morbidity and mortality, prolonged length of stay at facilities, and increased healthcare costs (Brennan, 2023). These complications can considerably affect a person's quality of life and daily functioning. Immobility has negative effects on a patient's psychological, cardiovascular, respiratory, gastrointestinal, metabolic, genitourinary, and immune function.

Psychological Effects

Patients who experience difficulties with ADLs are three times more likely to suffer from depression (Gyasi et al., 2023). Limited mobility can also cause anxiety, stress-related alienation from family and friends, emotional dysfunction, and a poor sense of belonging (Gyasi et al., 2023). For example, a patient with pain from arthritis may begin to cancel social meetings with friends and family, decreasing interactions with friends and family, and creating a sense of isolation. This could negatively affect mood and increase the patient's risk for depression. Depression can then lead to poor dietary habits or inability to follow a daily routine, placing the patient at risk for weight gain and further immobility.

Cardiovascular Effects

With prolonged bedrest and immobility, skeletal muscles that usually help compress valves in the leg veins during ambulation do not adequately contract, causing blood to pool in the veins of the legs. This decrease in venous return to the heart, also known as **venous stasis**, causes the heart to work harder to circulate blood, elevating the heart rate. The pooling blood in the legs also increases a patient's risk for venous thrombus formation and orthostatic

hypotension. A condition called **orthostatic hypotension** is a temporary drop in blood pressure when moving from a supine position to a sitting or standing position.

Respiratory Effects

Patients who are active often take deep breaths while actively performing tasks during the day. This stretches their lung muscles and provides them with extra air. Patients who are immobile take shallow breaths because it meets their respiratory needs. Lack of deep breathing deconditions the respiratory muscles and diminishes lung expansion. This can lead to blockages or lack of air to the alveoli and cause atelectasis, or partial or complete collapse of the lung.

Lack of deep breathing also decreases the cough reflex, limiting how well a patient can clear respiratory secretions from the lungs, increasing their risk for pneumonia. Inability of the heart to adequately circulate blood can cause blood to back up into the veins and alveoli of the lungs, causing pulmonary edema.

Gastrointestinal Effects

Immobility can affect digestive function by slowing down **peristalsis**, or the movement of food through the gastrointestinal system. Decreased peristalsis can cause constipation, increase in intestinal gas, abdominal distention, nausea and vomiting, fecal impaction, and ileus. Stomach acid can flow up from the stomach into the esophagus causing gastric reflux or heartburn. Anorexia and decreased fluid intake can also occur with immobile patients, either because of a lack of hunger or thirst or because of an inability to nourish themselves. Malnutrition can also occur.

Metabolic Effects

Mobility is essential for exercising, walking, and being physically active. When mobility is impaired, or there is a lack of access, a patient may develop metabolic issues. If a patient has a higher weight, or becomes immobile and gains weight, they may not be able to move at an intensity or frequency required to lose weight or prevent weight gain. This can lead to further mobility issues, and the development of metabolic diseases such as diabetes, leading to cardiovascular, neurological, and systematic disorders. Patients who have impaired mobility can still prevent the development of metabolic diseases and disorders by staying mobile even with their limitations, monitoring their nutrition, and setting realistic goals. Nurses should ensure that patients have the right equipment, are addressing the cause of the immobility, and are tailoring interventions specific to their needs and abilities.

Genitourinary Effects

Immobility can cause a patient to experience urinary retention or discomfort when urinating. Prolonged urinary retention can cause urinary tract infection (UTI) or kidney infection. Other examples include patients with incontinence or who void themselves which can cause tissue breakdown. Poor hygiene due to immobility or urinary statis, where urine stays in the bladder too long, can also lead to UTIs, especially in females.

Musculoskeletal Effects

Immobility causes decreased muscle mass, strength, and endurance. Immobility can also decrease flexibility, making movements more difficult and increasing the risk of falls and injuries. Immobilization can contribute to bone demineralization and osteoporosis, weakening the bones and increasing the risk of fractures. Connective tissue also shortens from limited use, and joints become stiff. This can cause complications such as decreased stability and balance, muscle atrophy, joint contractures, foot drop, and increased risk for falls. To mitigate these effects, individuals who are immobilized should receive interventions such as range-of-motion exercises, weight-bearing activities, and proper positioning to maintain musculoskeletal health and function.

9.3 Transferring Patients

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Recognize safety techniques when transferring, lifting, and ambulating patients
- Identify proper usage for various assistive devices
- Develop key aspects for patient education related to transfers

The nurse's assessment of the patient's mobility, strength, balance, and ADL status is critical to assisting the patient with transfer needs. The most common patient transfers completed by nurses are from a bed to a stretcher, from a

bed to a wheelchair, and from a wheelchair to a bed (Bergman & De Jesus, 2022). Patient transfers that are poorly managed are associated with higher fall rates, morbidity, and mortality (Bergman & De Jesus, 2022).

While there are many methods to transfer patients, the methods used must be safe for the patient and the nurse. One of the most common injuries reported by the worldwide healthcare workforce is musculoskeletal injuries. Nurses make up 37 percent of those injuries, and healthcare assistants make up 46 percent of those injuries (Albanese et al., 2022). Often these are the result of improper lifting, inadequate assistance or equipment, and lack of preparation for the transfer. The following section will discuss safe techniques to move patients including the use of transfer equipment.

Safety with Transferring, Lifting, and Ambulating Patients

Transferring a patient is moving a patient from one place to another. For example, patients may be moved from bed to chair, bed to stretcher, or stretcher to wheelchair. Safety is a top priority when transferring patients. This can be achieved using best practice standards and tailoring techniques based on the patient's unique needs. There are several factors to consider including:

- Is the patient physically able to transfer?
- Does the nurse have the proper equipment and have they been trained to use it?
- Has the nurse clearly communicated the steps with the patient?

LINK TO LEARNING

The U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) developed *Safe Patient Handling Programs* (https://openstax.org/r/77OSHASafe) to reduce musculoskeletal injuries in healthcare workers during patient transfer.

Falls can have serious consequences, especially for older adults, leading to declines in quality of life and functional performance. The Centers for Medicare and Medicaid Services focus on preventable falls. Hospitals that have a high number of preventable falls are financially penalized or receive incomplete reimbursement from the patient's insurance. Modifiable risk factors are scrutinized to determine if the fall could have been prevented with the use of assisted devices, changes in medications, or standardized safety measures. When assessing a patient using a standardized tool, modifiable risk factors for falls should be documented with interventions in place, especially before attempting to transfer a patient (Kiyoshi-Teo et al., 2019).

PATIENT CONVERSATIONS

How to Answer Patient Questions about Assistive Devices

Scenario: Carlton is visiting his brother, Sam, at the hospital and observes the different equipment available for Sam and his roommate, Perry. Sam is in the hospital for a cellulitis infection in his right lower extremity and Perry, a total care patient who has dimentia, was diagnosed with a urinary tract infection but is nearly recovered. Natasha is the registered nurse who is caring for both patients.

Patient's brother: Excuse me, Natasha. I don't mean to bother you, but I was wondering if you could answer some of my questions.

Nurse: Sure, Carlton, ask away.

Patient's brother: My brother will be discharged soon but he still has a lot of weakness in his right leg. How will he manage at home?

Nurse: Physical therapy has been working with him and has given Sam crutches to take home. He's practiced using them and is partial weight-bearing, meaning he can put some weight on his right leg to help keep himself supported and stabilized.

Patient's brother: That's great. I didn't realize that physical therapy was involved. Can I ask you another question?

Nurse: Of course!

Patient's brother: I see that Perry cannot get out of bed and needs to use that big contraption where he hangs. How does that work?

Nurse: Yes, that is the Hoyer lift. A pad that is specialized for the Hoyer lift is placed underneath Perry. The nurses and patient care assistants can get the pad underneath him by rolling Perry from side to side. Once the pad is underneath Perry, there are designated hooks and loops that will securely hold him when he is lifted up. The Hoyer can fit under the bed so it's easy to move the patient from the bed to the wheelchair. It's safe for Perry and helps us transfer him without compromising our backs.

Patient's brother: That's so interesting. It's great to have equipment in place to keep you and Perry safe.

Weight-Bearing Transfer

A person is **weight-bearing** if they can put force or body weight on a specific limb. There are several types of weight-bearing grades (Table 9.5). If a patient can bear weight, nurses should encourage their help with transfers. The nurse should stand by for safety.

Weight-Bearing Grade	Description
Full weight-bearing	The leg can tolerate the entire body weight, and can ambulate.
Weight-bearing as tolerated	Dependent on the circumstance, the patient can support 50 percent to 100 percent of entire body weight on the leg.
Partial weight-bearing	A small amount of weight can be tolerated on the leg. The patient needs an assistive device to ambulate, such as a cane or crutches.
Touch-down weight-bearing	The patient can use their toes of the affected leg to touch the ground for balance, but cannot support any weight on the leg.
Non-weight-bearing	The leg cannot touch the floor or support any body weight.

TABLE 9.5 **Weight Baring Grades** (Source: Anderson & Duong, 2023.)

For patients who can partially bear weight, nurses should use the stand-and-pivot technique, preferably using a gait or transfer belt or standing lift assist. A **stand and pivot** is a technique for patients, who can partially weight-bear, by moving from sitting to standing and then just turning with one leg to sitting again (Figure 9.15). A **gait belt** is a strap that is a few inches wide made of nylon, canvas, or leather. It is placed around a patient's waist to help nurses assist with transfers. In addition, the patient should transfer toward their stronger side if they have partial weight-bearing capabilities.

(a) (b)

FIGURE 9.15 The stand-and-pivot transfer technique can be used with a gait belt. While holding the belt, (a) gently rock back and forth three times and on the third time, (b) pull the patient into a standing position. (credit a: "Rock back and forth to provide momentum" by Glynda Rees Doyle and Jodie Anita McCutcheon, CC BY 4.0; credit b: "Pulled to a standing position" by Glynda Rees Doyle and Jodie Anita McCutcheon, CC BY 4.0)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Transferring a Patient from the Bed to a Chair

See the competency checklist for Transferring a Patient from the Bed to a Chair. You can find the checklists on the Student resources tab of your book page on openstax.org.

Non-Weight-Bearing Transfer

A **non-weight-bearing** injury is when the affected limb or limbs cannot support any weight. In injury or recovery, patients may have practitioner orders to maintain non-weight-bearing status with a certain limb to aid in healing. Premature weight-bearing can delay recovery and lead to complications. Transfer devices, such as a full body sling lift or slide board, should be utilized as appropriate.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Transferring a Patient from the Bed to a Stretcher

See the competency checklist for Transferring a Patient from the Bed to a Stretcher. You can find the checklists on the Student resources tab of your book page on openstax.org.

Sling Transfer

A **sling transfer** is a patient transfer from a bed, wheelchair, toilet, or shower using a lift machine and flat piece of material placed under the patient (Figure 9.16). The use of the sling carries the full weight of the patient, reducing the risk of injury for the patient and caregiver. The slings are fitted to the patient to provide neck, head, and shoulder support.

FIGURE 9.16 These nurses are training on how to transfer a patient using a sling lift. (credit: "U.S. Navy Medical Team Integrates with Spokane Hospital 211017-A-KC249-1093" by Sgt. Yesenia Barajas/Navy Medicine/Flickr, Public Domain)

When transferring with a sling, the equipment used to transfer should be appropriate for the sling and applied correctly. Equipment should never be substituted if the correct item is not available. Most facilities and lift manufacturers require two caregivers to safely operate a patient lift. If the lift has wheels, make sure they are locked. Slide the sling under the patient by either having them roll side to side or lean forward. The patient's arms should be as close to the sides of their body to help keep the weight centralized. During transfer it is important for the nurse to continuously communicate with the patient as they may be fearful or anxious about falling. Each transfer should be carefully planned, as all have varied requirements.

LINK TO LEARNING

This video provides step-by step instruction on how to safely operate a Hoyer lift (https://openstax.org/r/77Hoyer) to transfer a patient. A Hoyer lift is a type of sling transfer.

Sliding Board

A **sliding board** is a piece of equipment that is flat and rigid, used for patients who cannot complete a transfer between two surfaces or if a standing transfer is not safe (Figure 9.17). The board makes a "bridge" between the bed and the other surface, such as a stretcher, and the patient can slide between the two. The nurse should always use a gait/transfer belt for safety and instruct the patient to move slowly and deliberately across the board if they are assisting with the transfer. Skin precautions are essential to prevent sheering and friction.

FIGURE 9.17 The nurse is using a sliding board to assist the patient to get out of bed to a wheelchair. (credit: ADA.gov, U.S. Department of Justice Civil Rights Division, Public Domain)

Various Assistive Devices

Assistive devices can give patients mobility and the ability to transfer from one location to another. Allowing patients to participate in active transfers, if they are able, can help promote functional independence. At home, patients may find ADLs challenging; therefore, the use of assistive devices is vital, especially for older adults, to maintain mobility, remain safe, and enable communication with others. Assistive devices can include self-care devices to accomplish daily tasks, mobility devices that help with moving around and walking, and safety assistive technology that can help with lack of balance, weakened limb function, decreased eyesight, and other sensory issues.

Gait Belt

A gait belt can also be used as a device to assist an unsteady patient with ambulation. The nurse holds the gait belt to steady themselves and the patient as they move around together. Gait belts have been found to reduce the incidence of patient falls as well as physical stress on the nurse (Figure 9.18).

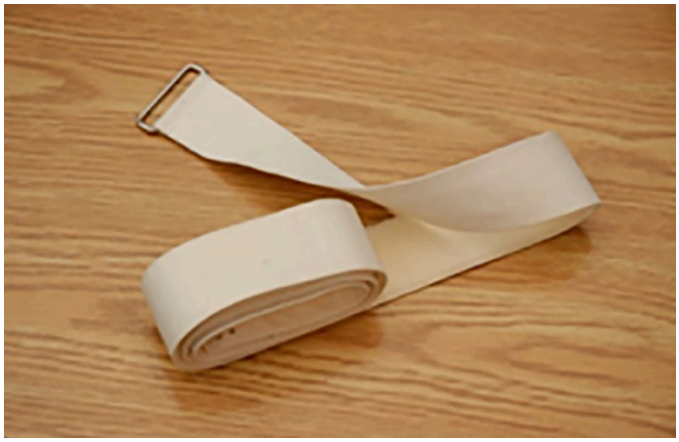


FIGURE 9.18 A traditional cloth gait belt has a buckle to make it adjustable for most patients. (credit: modification of work "Gait Belt.jpg" by Glynda Rees Doyle and Jodie Anita McCutcheon/Wikimedia Commons, CC BY 4.0)

When utilizing a gait belt as an assistive device:

- Ensure the patient is wearing nonslip footwear.
- Place the gait belt snugly over a layer of clothing.
- Ensure two fingers fit between the belt and the patient, ensuring it is not too tight.
- Face the patient with the back straight, knees bent, in a wide stance while preparing to lift the patient from sitting to standing.
- Grab the gait belt on both sides of the patient and straighten your body as the patient rises.
- Stand behind and to the side of the patient when ambulating, and use an underhand grip to grasp the loop on the back of the gait belt.
- Maintain open communication with the patient throughout the procedure, and encourage the patient to promptly report any discomfort or fatigue.

Contraindications in using a gait belt include patients who have abdominal aneurysms, G tubes, hernias, or severe cardiac or respiratory conditions and patients who have had recent chest, back, or abdominal surgery.

Crutches

Devices called **crutches** are an aid used for standing, walking, and mobility for patients who cannot support the weight of their bodies with their leg, knee, or ankle. The patient's weight-bearing status will determine how much pressure can be put on the affected limb. There are three types of crutches: axilla, elbow, and gutter.

An axillary (underarm) crutch should be two fingers distant between the axilla and axilla pad of the crutch. The patient's weight should be focused where their hands grip the crutch and not under their armpits. This is to prevent axillary nerve damage.

LINK TO LEARNING

This video provides instruction on how to properly use axillary crutches (https://openstax.org/r/77axillary) and includes different gait techniques.

Forearm (lofstrand, elbow, or Canadian) crutches have a forearm cuff and handgrip. These are often used long term in patients with lower extremity disabilities.

LINK TO LEARNING

This forearm crutches demonstration (https://openstax.org/r/77forearm) gives proper instruction on how to these crutches.

Gutter crutches are modified forearm crutches and a modified hand grip for patients who may not have mobility and

strength in their hands. This type of crutch can be recommended for patients with rheumatoid arthritis. Crutches should be tailored to the patient and fit according to their height.

LINK TO LEARNING

This gutter crutches demonstration (https://openstax.org/r/77gutter) shows patients ambulating using these crutches.

Nurses can teach patients how to walk with crutches by having them clasp the hand grips, move both crutches forward at the same, swing their "good" limb through, and land with a shorter stride.

Knee walkers (knee scooters or mobility scooters) are used as well to help with lower limb mobility. This wheeled crutch alternative allows the injured foot and/or leg to be elevated on a padded platform. The patient can balance naturally on two legs and can move by pushing with the good leg and steering with the handlebar.

Walker

A **walker** is an aide that has four points of contact with the ground. Walkers provide a greater base of support, assisting in stability for balance and mobility. There are many types of walkers including standard, two-wheeled, upright, and four-wheeled walkers. Standard four-point walkers (four-point or Zimmer frame) are used with the patient taking one step forward and then the patient moving into the walker (Figure 9.19). Two-wheeled walkers are used the same way except the walker can slide forward instead of the patient needing to pick it up because there are two rear wheels (Figure 9.20a). Four-wheeled walkers have handles to control brakes and may also have a seat, tray, or basket (Figure 9.20b). The patient must remember to lock the brakes when stationary to avoid the risk of a fall. The gutter frame walkers are wheeled and adapted to patients who need more support. Forearm supports fix the elbows at 90 degrees.

FIGURE 9.19 This patient is ambulating with a standard four-point walker, also known as a four-point or a Zimmer frame walker. (credit: "A woman supporting herself with a walking frame.jpg" by "rawpixel.com"/Wikimedia Commons, Public Domain)

(a) (b)

FIGURE 9.20 (a) A two-wheeled walker has wheels that allow the patient to slide the walker forward without fully lifting it off the ground. (b) A four-wheeled walker often has brakes, a seat, and a basket. (credit a: attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license; credit b: modification of work "Rollator.jpg" by "DirkvdM"/Wikimedia Commons, CC BY 3.0)

Cane

A **cane** is a singular assistive device that assists in balance when walking or helps compensate for an injury or disability. A cane can either have a single tip or four points that touch the ground, called a quad cane. The quad cane provides a broader base of support. The grip on canes can vary by size and material. Some may be made of foam or plastic, and sizes may vary for arthritic hands. The patient's elbow bend and wrist height should be taken into consideration when fitting a cane for a patient (Figure 9.21). The elbow should bend at a comfortable angle, approximately 15 degrees, and the top of the cane should line up with the crease on the patient's wrist. Patients should hold the cane in the opposite hand of the weak or painful limb. The cane should move with the affected leg.

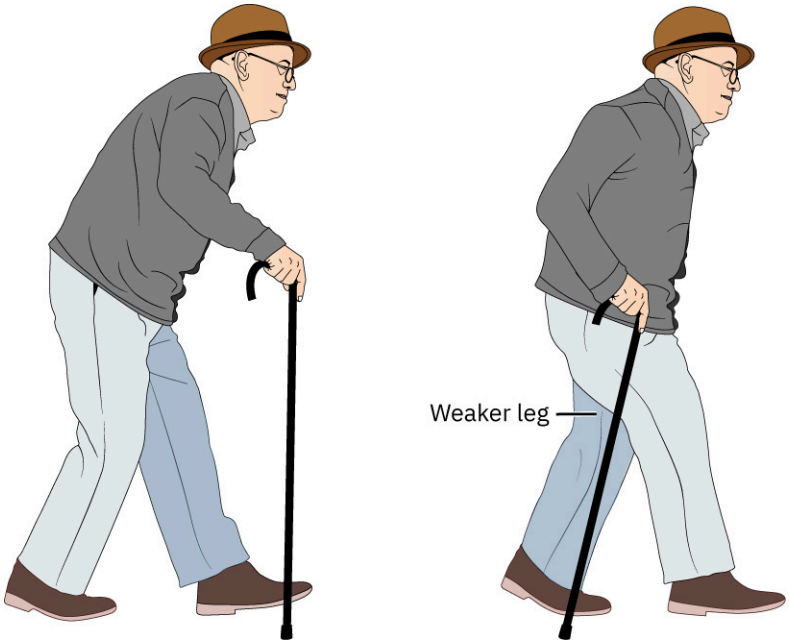


FIGURE 9.21 In this illustration, the patient is holding a cane on the opposite side of the weaker leg and maintaining a slight bend in the elbow during ambulation. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

CULTURAL CONTEXT

Culture and Assistive Devices Awareness

Racial and ethnic disparities exist in health care, which include the use of assistive devices among older adults. Assistive devices are meant to extend independence in aging; however, the rate of use of assistive devices among older adults living in Hispanic communities is lower than other populations (Orellano-Colon et al., 2016).

Barriers reported by Hispanic community-living older adults include the following:

Human Barriers

- lack of knowledge about assistive devices including availability, acquisition, or the use of devices for ADL assistance
- safety concerns with many participants fearing that the equipment will break or they may fall
- dislike for assistive devices and a lack of perceived usefulness
- concern of losing functional capacities if assistive devices are used

Assistive Device Barriers

- complexity in the use of assisted devices
- the equipment failed or is unattractive in appearance

Context Barriers

- financial limitations
- lack of access to the physical environment including not having enough space
- institutional systems barriers that prevent access to equipment and services
- social stigma with use of assistive device

There are multifactorial reasons why the use of assistive devices among older people in the Hispanic community is lower than other populations. Social determinants of health, language, and understanding, as well as education, are factors that need to be considered when working with patients of varied cultures.

UNFOLDING CASE STUDY

Unfolding Case Study #2: Part 5

Refer back to Unfolding Case Study #2: Part 4 to review the patient data.

Nursing Notes	**1430:** Patient educated about importance of maintaining mobility to improve functional status. Patient expressed understanding of teaching and willingness to work with physical therapy to improve strength. Patient reminded to use call light before getting up and fall risk precautions in place.
Provider's Orders	Physical therapy consult Orthostatic vital signs daily

4. Generate solutions: In addition to starting physical therapy, what are some other interventions the nurse could implement to improve the patient's mobility and overall functional status?
5. Take action: The nurse determines it would be appropriate to implement the use of assistive devices to help the patient with walking to the bathroom. What assistive device is most appropriate for this patient?
   a. crutches
   b. gait belt
   c. cane

d. sling transfer

6. Evaluate outcomes: The nurse decides to use a gait belt for ambulation to the bathroom. What findings would indicate that use of the gait belt is effective for this patient?

Patient Education Related to Transfers

In transfers and assistance with mobility, patient education is important to maintain safety and ensure a successful process. Be sure to include education about

- the importance of remaining engaged to maintain safety;
- maneuvers during transfer, such as pivoting, and ensure the patient understands directions before proceeding;
- any equipment or assistive devices being used, including safety measures;
- signs and symptoms of any distress during the procedure to report to the nurse; and
- if unable to transfer independently, provide education on calling for assistance and use of call light.

The nurse should always ask permission and inform the patient of all the steps of the transfer or equipment use. Explain all steps in simple and clear terms, gather all the necessary equipment for the transfer, and cue the patient to perform as much as possible. Ensure that the patient has proper alignment of the spine and limbs and is wearing the proper clothing (e.g., nonslip footwear, a nonrestrictive hospital gown). Before transfer, the nurse should institute skin precautions, request additional personnel assistance, if needed, use proper body mechanics, and lock and stabilize equipment.

9.4 Positioning in Bed

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe how improper positions can lead to musculoskeletal complications
- Recognize different devices used for joint support, pressure relief, or proper alignment
- Demonstrate common positions for patients who are immobile

Similar to safe patient transfers and ambulation, the position of patients in bed is also important in maintaining healthy body systems and preventing complications from musculoskeletal injuries and skin breakdown. This section will review patient positioning to prevent complications from immobility, as well as common devices used to aid in patient positioning and body alignment.

Positioning to Prevent Musculoskeletal Complications

An patient who is immobile in bed for long periods of time is at risk for musculoskeletal complications due to reductions in muscle mass and bone mineral density, improper body alignment, and impairment of other body systems. Prolonged time in bed has shown to increase recovery time for patients and impact long-term outcomes. Proper positioning can aid in preventing some of these complications, such as external rotation of the hip and foot drop.

Positioning to Prevent External Rotation of the Hip

Special instructions may be given to patients after surgery to assist in recovery and prevent pain and injury. Patients have just had hip surgery should prevent their legs from **abduction** (rotating out and away from the body), causing external rotation of the hip, to promote proper alignment and healing. The patient's provider and physical therapist will make recommendations for the length of time for recovery and restrictions. Typical positioning restrictions include avoiding active extension at the hip and external rotation. In bed, patients should avoid sleeping on the affected side and should have an **abductor pillow** between their legs, which keeps the hips in a neutral position to avoid external rotation away from the body, and **adduction** (movement close to the midline of the body). While seated, patients should not bend over (Figure 9.22) or raise their feet to prevent hip hyperflexion and external rotation.

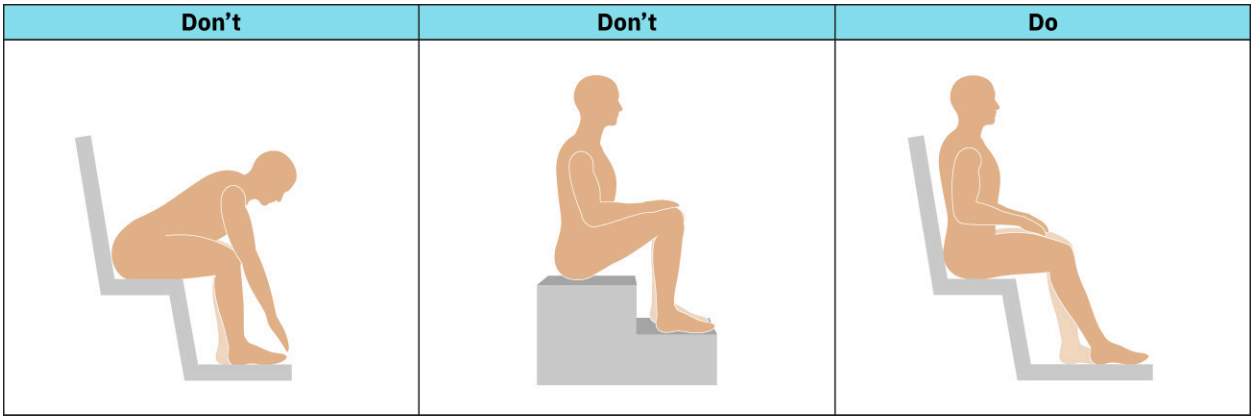


FIGURE 9.22 Excessive hip flexion and external rotation can hinder progress with injury recovery. When sitting in chairs, patients should avoid bending over or overflexing the hip by sitting at a 90-degree angle. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Positioning to Prevent Foot Drop

When lying supine in bed, feet naturally fall into plantar flexion because of gravity. If this position is maintained for long periods of time, damage to the muscles in the foot can cause foot drop syndrome. A condition called **foot drop syndrome** is the inability to raise the front part of the foot due to weakness and paralysis of the dorsiflexors that allow the foot to lift and maintain itself in a perpendicular position; foot drop syndrome makes walking difficult (Figure 9.23). Foot drop syndrome can affect one or both feet, and can be temporary or permanent. Patients are at a high risk for foot drop syndrome if they are on bedrest for extended periods of time, or have compressive nerve disorders, traumatic injuries, or neurologic disorders. To prevent foot drop syndrome, orthotics designed to keep the foot at a 90-degree angle should be worn while in bed.

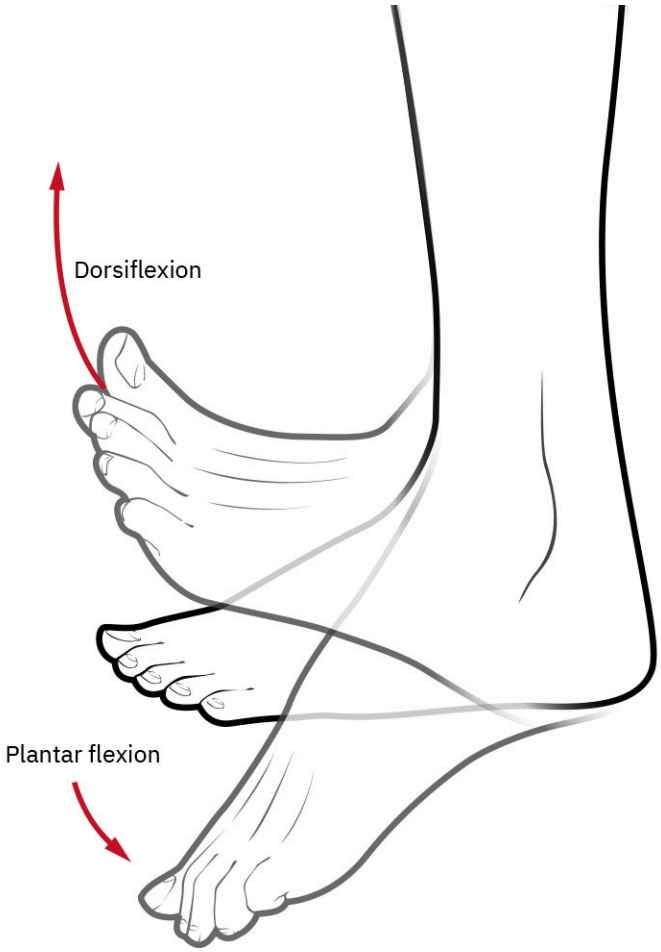


FIGURE 9.23 Normal range of motion allows for dorsiflexion and plantar flexion. Foot drop can be caused by nerve damage resulting in the

inability of the foot to dorsiflex. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

One of the most common orthotics used for foot drop is a **podus boot**. The brace covers the ankle and foot to support the muscles, immobilizes joints, and corrects positioning.

Positioning to Prevent Skin Integrity Complications

Immobility can lead to skin breakdown and the development of pressure injuries. A pressure injury is defined as any localized damage to the skin as well as underlying soft tissue, usually occurring over a bony prominence or related to a medical device (The Joint Commission, 2022). Common areas where pressure injuries develop include the coccyx, heels, ears, and other bony prominences (Figure 9.24). Within a few hours, they can start developing in patients who are bedbound, so it is important to minimize pressure, friction, and shear. The nares of the nose is another location. Oxygen tubing can cause pressure injuries here if a patient is immobile and unable to move the tubing.

The **repositioning** step, which is a change in position of the patient, either passive or assisted, reduces or relieves pressure in areas prone to injury during long periods of pressure. Repositioning can be done with the use of equipment, pillows, wedges, or other assistive aides to relieve pressure.

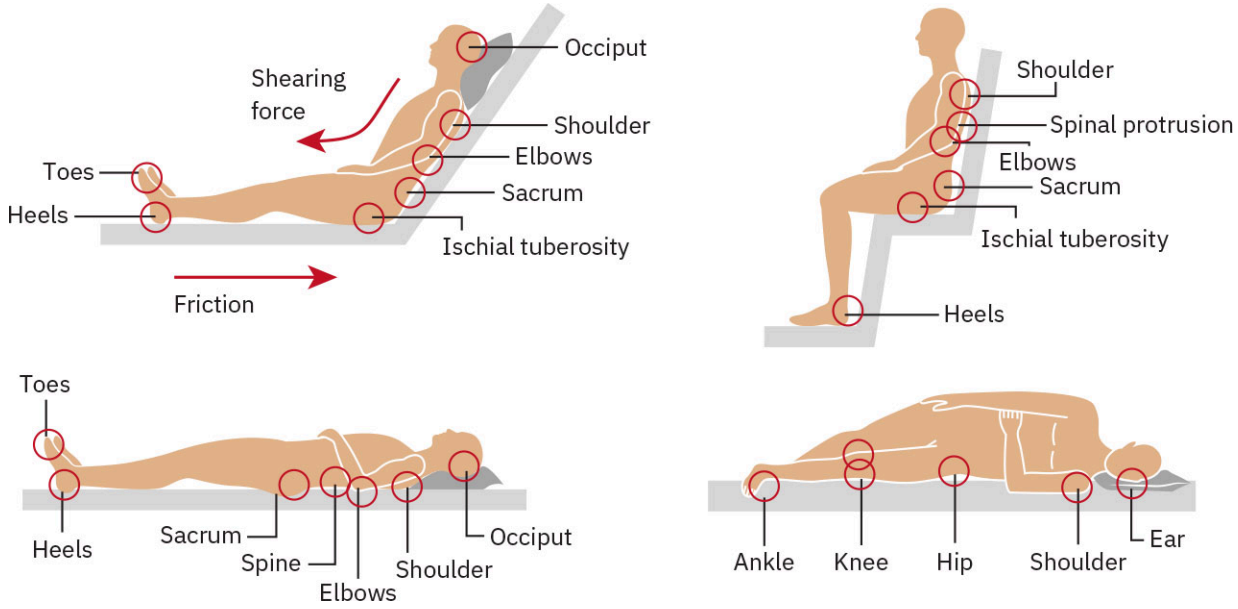


FIGURE 9.24 Pressure injuries commonly occur on bony prominences. As the position of the patient changes, so do the areas that are at risk. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Interventions to prevent pressure injury include identifying patients who are at risk for injury as soon as possible. This can be done using a validated assessment tool, such as the Braden Scale, at the beginning of each shift and as the patient's condition changes. Interventions include repositioning at least every two hours, alternating between the sides and back, and using cushions to help alleviate pressure. Ensure that any medical devices, such as IV or catheter tubing, are not under the patient or pressing into the skin. It is also important to complete a skin assessment with every position change.

The heels can be vulnerable to skin breakdown with constant pressure from the bed. Using pillows to float the heels or using splint devices is an option to reduce pressure. One example is a heel protector, which is designed to adapt to the patient's foot with adjustable Velcro straps. The material inside the boot-like device is soft and evenly distributes weight to alleviate pressure.

LINK TO LEARNING

Learn more about the Braden Scale (https://openstax.org/r/77BradenScale) and how it is used to determine a patient's risk for skin breakdown.

Specialty Mattress

To prevent skin breakdown and muscle wasting in patients who are immobile, specialty mattresses can be used for patient comfort. A **specialty mattress** is a mattress designed to relieve pressure over bony prominences and prevent injury. Alternating pressure mattresses are designed to reduce friction and shearing and relieve and distribute pressure. Weight is either distributed over a large contact area or mechanically distributed in active therapy. Some common materials, which are low-tech and do not provide adjustable pressure, include air, foam, or gel. Hi-tech mattresses are pressure-adjustable and can be inflated or deflated.

A **gel overlay mattress** is made with a combination of foam and gel, and conform to the patient's body and retain less body heat. A **foam mattress** is made of crosscut foam, which allows parts of the mattress to shift along with the patient's body. A constant low-level pressure is placed on the body until repositioning occurs. A **low air loss mattress** delivers active therapy by pushing air through tiny holes on the surface of the mattress to keep the skin dry, wick moisture, and accommodate pressure points. It is attached to an air pump or compressor that maintains inflation. An **alternating pressure mattress** is powered with air and can be programmed to inflate and deflate certain sections in a programmable cycle. These mattresses are commonly used when a pressure injury is present.

Devices Used for Joint Support or Proper Alignment

Proper alignment is defined as joints, tendons, ligaments, and muscles in line with the pull of gravity. This should be true with lying, sitting, or standing and should not cause excessive stain. Along with the assisted devices that were mentioned in the mobility section, wedge pillows, towels, washcloths, and pillows can also aid in alignment. The body should be aligned so that the spine is straight, head is neutral, and extremities are in functional positions.

Wedge Pillows

A **wedge pillow** is a large triangular pillows made of foam that elevate different parts of the body (Figure 9.25). Wedges can be used to elevate limbs at an angle, relieve pressure off certain points, or keep the torso supported. Most commonly in the hospital setting, wedge pillows are used behind the patient's back to maintain a side-lying position.

FIGURE 9.25 A wedge pillow can be used in a variety of ways to position patients. (credit: "Best Wedge Pillow for Back Pain" by Carlton Martinez/Flickr, CC BY 2.0)

Towels and Washcloths

Towels and washcloths are easily accessible in most facilities and are easy to use when positioning patients. They serve as adaptable aids in repositioning patients by providing targeted support and alignment. Rolled towels can be strategically placed under specific body parts to alleviate pressure points, support limbs and joints, and maintain proper spinal alignment. For example, a nurse may place a rolled washcloth under the palm of a patient's contracted hand to wick moisture and maintain a more neutral position of the fingers.

Pillows

Pillows can also aid in elevating extremities and providing support. For patients in a side-lying position, placing a pillow between the knees can prevent pressure injury. Pillows can also be used by the patient to splint the abdomen when doing cough/deep-breathing exercises. Additionally, specialized pressure-relief pillows can help distribute weight evenly, mitigating the risk of pressure ulcers in patients who are bedridden. With their soft and pliable nature, pillows offer not only physical support but also psychological comfort, creating a conducive environment for rest and

recovery.

Splints

A **splint** is a firm support that can be made of metal, plastic, or plaster. They are often used to immobilize or provide extra support to an extremity to promote healing. Splints maintain the extremity in a neutral position to prevent or treat shortening of the muscles and connective tissue.

Common Positions for Immobile Patients

Generally, patients who are immobile and bedbound require repositioning at least every two hours. This reduces the risk of pressure injury, helps blood circulation, and allows frequent skin assessments. Often, diagrams are placed to help nurses and ancillary staff determine the time patients need to turn (Figure 9.26).

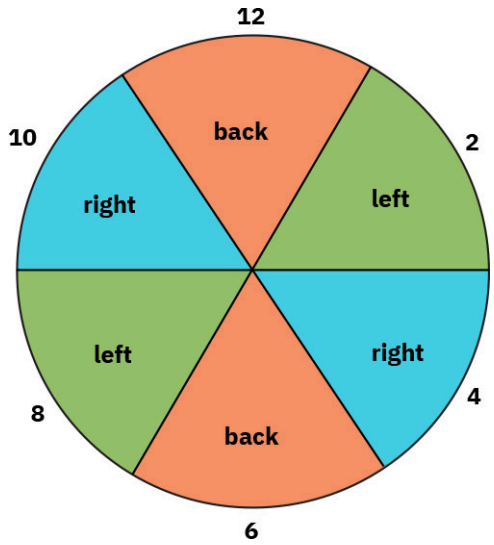


FIGURE 9.26 A diagram can serve as a reminder to assist nurses and ancillary staff in maintaining a two-hour turn schedule. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Pillows, wedges, sheets, and towels can help align patients in a comfortable position. Common positions include supine, Fowler's, orthopneic (tripod), prone (stomach), lateral (side-lying), and Sim's (semiprone) (Table 9.6).

Position	Description	Illustration
Supine	Patient lies flat on the back with a pillow for head support.	(attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Fowler's	Patient lies supine but with the head of the bed raised.	(attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

TABLE 9.6 Common Patient Positions

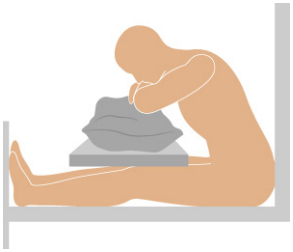
Position	Description	Illustration
Orthopneic (tripod)	Patient is in a sitting position, leaning on an overbed table.	 (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Prone	Patient lies on the abdomen.	(attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Lateral (side-lying)	Patient lies on the side with the top leg flexed for support.	(attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Sim's (semiprone)	Patient lies in a position between prone and lateral positions.	(attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

TABLE 9.6 Common Patient Positions

9.5 Limited Movement Devices

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Recognize the need for devices that cause limited mobility
- Identify the need for use of restraints
- Describe nursing considerations for restraint management

Devices may sometimes be needed to immobilize a joint or keep a body part in a fixed position for a period of time. This is common in treating various injuries, during medical imaging, and after certain surgeries or procedures. An **immobilization device** is any device, including casts, braces, slings, traction, and external fixation, that keeps a part of the patient's body in a fixed position. These devices keep the bone or joint immobile after realignment to aid in proper healing. Restraints are devices used to treat unsafe patient behavior by intentionally limiting the movement of the patient. This unit will discuss the different types of devices used to limit mobility and promote healing. It will also identify different types of restraints, when they are appropriate, and nursing considerations in managing a patient in restraints.

Need for Devices That Cause Limited Mobility

A bone or soft tissue injury may warrant limiting mobility in a joint or limb. The limitation of movement allows the body to repair the injury without the risk of re-injury, complications, or further damage. For example, if a patient breaks their ulna, immobilization of the lower arm will hold the bones together while they heal, reduce pain and swelling, and limit muscle spasms. Another example is that a patient who has a fractured neck may need to wear a cervical collar to ensure proper neck alignment, promote proper healing, and prevent further injury.

Casts and Braces

Immobilization can be completed with casting or bracing. A **cast** is a hard mold that is set around the limb to prevent it from moving. Casts can be made from plaster or fiberglass. The hardened cast maintains proper alignment of fractured bones or soft tissue injuries while they heal (Figure 9.27). Because the affected limb is immobile, it also promotes continued mobilization of the patient. Casts remain on until the injury heals, which can range anywhere between four and twelve weeks, depending on the injury.

FIGURE 9.27 This patient has a fracture in the hand, and the cast immobilizes the wrist, intercarpal area, and the metacarpal joints. (credit: modification of work "Getting A Cast On His Arm - 6022671962.jpg" by “slgckgc”/Wikimedia Commons, CC BY 2.0)

If the cast is too tight or if the limb has swelling, the increased pressure on the capillaries, muscle, and nerves causes a disruption in blood flow, causing compartment syndrome. Left untreated, it can cause permanent tissue damage. It is important that the nurse monitor capillary refill, pulses, temperature, motor function, edema, and sensation of the affected limb and monitor for acute pain. Cast tightness can also cause pressure injury or skin infection.

A **functional brace** is applied to a limb to heal a fracture, but has the ability to be removed or adjusted. These types of braces are appropriate for a fracture in the tibia or femur. Patients need to remember that if a functional brace is used, the recovery may be delayed; therefore, healing should be in progress with a traditional cast before a functional brace is considered.

Slings and Bandages

A **sling** is used to support an upper limb by limiting movement or immobilizing the arm to prevent movement in the wrist, elbow, or shoulder. Common injuries that require a sling include surgery; an injured upper arm, wrist, forearm, or shoulder; or a rib or clavicle fracture. A large triangular bandage, or a custom or ready-made sling from cloth, can be used as a sling. The strap of a sling goes around the neck to keep the arm stabilized (Figure 9.28). If the sling is designed to immobilize the arm and shoulder joint, there may be an additional strap that goes around the waist to hold the arm close to the body. Patients should follow provider orders about the frequency of having the sling on and exercises to prevent complications such as frozen shoulder.

FIGURE 9.28 A sling relieves pressure and allows for a patient's arm to heal. (credit: "Woman with Arm in Sling Holding Tennis Racket - Sports Injury" by Our SportingLife/Flickr, CC BY 2.0)

Assessment of the arm and hands should be done regularly to monitor for poor circulation or swelling. Symptoms of poor circulation include a change in color of the fingers and hands, cold skin, decreased capillary refill, decreased motor function and sensation, and numbness or tingling in the hands and fingers.

A **bandage** can be used for slings, to hold splints in place, provide support for the limb or joint, or restrict movement. Bandages should be taut but not to the point of compromising circulation. Skin integrity around the bandage, sensation and color in the extremities, and edema should be monitored closely to prevent complications.

Skeletal Traction

A **traction** in orthopedics describes the process of pulling on a broken bone or dislocated part of the body, in a slow and steady manner, to realign and stabilize it into the proper position. Generally, this can be done with ropes, pulleys, and weights. A **skeletal traction** uses pins, wires, or screws inserted distally from the fracture of the bone to create traction by attaching a string and weight (Figure 9.29). The weight pulls the broken bone into place over time. Patients who have been in major trauma accidents where multiple bones are broken may require traction before surgery to align the bones as much as possible and allow the patient to heal from other injuries.

FIGURE 9.29 The patient in this image has a femur fracture, and is in skeletal traction with a pin through the tibia. (credit: "Bohler's splint with extension 01.jpg" by "AfroBrazilian"/Wikimedia Commons, Public Domain)

Patients in skeletal traction require safe patient positioning to ensure the weights that create the traction remain suspended at all times. A trapeze should be made available to aid the patient in independent movement and repositioning. Proper cleaning around the skin of the pin sites is also important to prevent infection. Monitor the skin around the pin site for signs or symptoms of infection, such as redness, swelling, warmth to the touch, or drainage.

External Fixation

An **external fixation** is fixation of a fracture where pins and wires are inserted into the bone percutaneously and held together externally. This type of fixation is commonly done for open fractures, fractures that have exposure to the outside environment, fractures with severe tissue or wound contamination, or pelvic fractures. The fixators can provide alignment and stability to the bones temporarily (Figure 9.30). Ensuring pin care, cleaning the fracture site, and treating the wound can prevent complications such as skin infections or osteomyelitis.

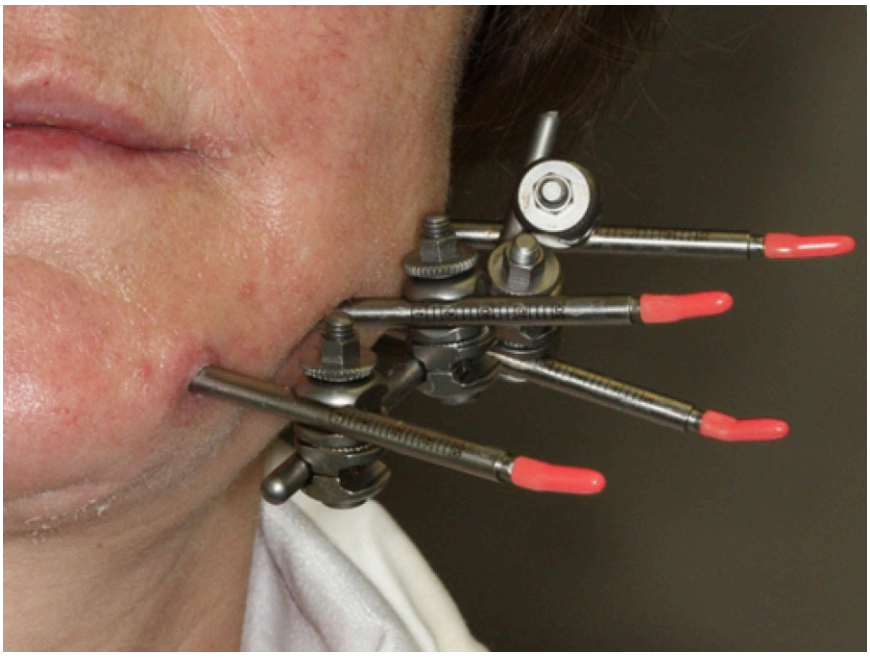


FIGURE 9.30 External fixation of the mandible holds the bones in place as the fracture heals. (credit: "External fixation mandible.jpg" by Coronation Dental Specialty Group/Wikimedia Commons, CC BY 3.0)

Use of Restraints

A **restraint** is defined as any measure, physical or pharmacological, that prevents or reduces the full movement of the patient during hospital care (Parkes & Tadi, 2022). The Joint Commission requires that organizations aim to have a restraint-free environment, and if restraints must be used, they are to be used safely (The Joint Commission, 2023a). Restraints should only be used when alternatives cannot meet the needs of the patient or provide the safety of the patient and healthcare staff (The Joint Commission, 2023b). The most common reasons are to prevent injury to self or others, and prevent the patient from dislodging medically necessary IV lines and/or airway tubes from ventilators.

Although restraints are used with the intention to keep a patient safe, they impact a patient's psychological safety and dignity and can cause additional safety issues and death. A restrained person has a natural tendency to struggle and try to remove the restraint and can fall or become fatally entangled in the restraint. Furthermore, immobility that results from the use of restraints can cause pressure injury, contractures, and muscle loss. Restraints take a large emotional toll on the patient's self-esteem and may cause humiliation, fear, and anger.

If a restraint is needed, the least restrictive restraint should be selected in order to maintain safety while permitting the most freedom of movement to the patient. For example, to prevent the dislodging of an IV line, padded mitts are less restrictive than wrist ties, because the patient maintains full ROM of their extremities. Another example would be the use of all four side rails of the bed in the upright position, instead of a vest restraint, to prevent the patient from sliding or rolling out of the bed.

Physical Measures

A **physical restraint** is any manual, physical, or mechanical device, material, or equipment attached to or adjacent to the patient's body that the individual cannot remove easily and restricts movement or normal access to one's body. Examples include wrist restraints, padded mitts, and vest restraints (Table 9.7). Nurses should be aware that physical restraints also include common supplies and devices such as sheets, towels, blankets, elbow splints to prevent the patient from bending an arm with an IV, and side rails if they are used in any way to restrict patient movement.

Restraint Type	Patient Considerations
Soft mitt restraint	• Indicated for patients to prevent them from grasping at tubes or dressings. Considered less restrictive because the patient maintains full ROM. • Ensure the patient does not bite at or ingest the mitt material.
Soft wrist restraint	• Indicated for nonviolent patients to prevent them from pulling at breathing tubes, IVs, dressings, or any other aspect of care that could cause patient injury • Must be tied correctly to prevent noose-like tightness when patient moves their wrist

TABLE 9.7 Types of Physical Restraints

Restraint Type	Patient Considerations
Vest restraint	• Used to prevent falls while in bed and aid in positioning while patients are in a chair or wheelchair • If applied incorrectly, can cause strangulation, suffocation, or chest compression of the patient
Violent restraint	• For violent patients at risk for harm to themselves and others • Can be used on the wrists alone, or on wrists and ankles (four-point restraint) • Meant to be short term until other measures can be done to calm patient • Patient requires continuous observation while in violent restraints

TABLE 9.7 Types of Physical Restraints

LINK TO LEARNING

This video provides instruction on how to apply different types of physical restraints (https://openstax.org/r/77restraints2) as well as special considerations for each type.

Pharmacologic Measures

A **chemical restraint** is any drug that is used to manage a patient's behavior in order to reduce the safety risk to the patient or others. Drugs used as a chemical restraint should have a rapid onset and minimal side effects to the patient (Parkes & Tadi, 2022). Frequently used drugs include benzodiazepines, first-generation antipsychotics, and second-generation antipsychotics. Examples of situations where chemical restraint would be appropriate include

- a severely violent patient in need of rapid tranquilization,
- agitation from drug or alcohol withdrawal, and
- psychotic or manic episode with severe agitation.

Nursing Considerations for Restraint Management

The American Nurses Association (ANA) has established evidence-based guidelines that state a restraint-free environment is the standard of care. The ANA encourages the participation of nurses to reduce patient restraints and seclusion in all healthcare settings. Restraining or secluding patients is viewed as contrary to the goals and ethical traditions of nursing because it violates the fundamental patient rights of autonomy and dignity. However, the ANA also recognizes there are times when there is no viable option other than restraints to keep a patient safe, such as during an acute psychotic episode when patient and staff safety are in jeopardy due to aggression or assault. The ANA also states that restraints may be justified in some patients with severe dementia or delirium when they are at risk for serious injuries such as a hip fracture due to falling.

The ANA provides the following guidelines: "When restraint is necessary, documentation should be done by more than one witness. Once restrained, the patient should be treated with humane care that preserves human dignity. In those instances, where restraint or therapeutic holding is determined to be clinically appropriate and adequately justified, registered nurses who possess the necessary knowledge and skills to effectively manage the situation must be actively involved in the assessment, implementation, and evaluation of the selected emergency measure, adhering to federal regulations and the standards of The Joint Commission (2009) regarding appropriate use of restraints." (American Nurses Association, 2012). Nursing documentation typically includes information such as patient behavior necessitating the restraint, alternatives to restraints that were attempted, the type of restraint used, the time it was applied, the location of the restraint, and patient education regarding the restraint.

Any healthcare facility that accepts Medicare and Medicaid reimbursement must follow federal guidelines for the use of restraints. These guidelines include the following:

- When a restraint is the only viable option, it must be discontinued at the earliest possible time.
- Orders for the use of seclusion or restraint can never be written as a standing order or PRN (as needed).
- The treating physician must be consulted as soon as possible if the restraint is not ordered by the patient's treating physician.
- A physician or licensed independent practitioner must see and evaluate the need for the restraint within one hour after the initiation.
- The patient must be continually assessed. Generally, the best practice is every fifteen minutes for continued use of the restraint, and in the case of an applied restraint, the restraint should be removed and the area assessed every hour. Some agencies require a 1:1 patient sitter when restraints are applied.
- Each written order for a physical restraint is limited to four hours for adults, two hours for children and adolescents ages 9 to 17, or one hour for patients under age 9. The original order may only be renewed in accordance with these limits for up to a total of twenty-four hours. After the original order expires, a physician or licensed independent practitioner (if allowed under state law) must see and assess the patient before issuing a new order.

Alternatives to Restraints

Many alternatives to using restraints in long-term care centers have been developed. Most interventions focus on the individualization of patient care and elimination of medications with side effects that cause aggression and the need for restraints. Common interventions used as alternatives to restraints include routine daily schedules, regular feeding times, easing the activities of daily living, and reducing pain.

Diversionary techniques such as television, music, games, or looking out a window can also be used to help to calm a restless patient. Encouraging restless patients to spend time in a supervised area, such as a dining room, lounge, or near the nurses' station, helps to prevent their desire to get up and move around. If these techniques are not successful, bed and chair exit alarms or the use of a sitter at the bedside are also considered alternatives to restraints.

Summary

9.1 Assessing Functional Ability

Assessing a patient's functional status is important in planning care. There are many validated and standardized tools to assess the patient's baseline status. These tools are to be used not only by the nurse but also with input and discussion among the interprofessional team members, such as physical therapy, occupational therapy, physicians, other nurses, and patient care technicians. Nurses and their colleagues should always have a plan of care based on their assessment and data from the tool. This allows for a personalized plan with interventions to promote patients' functional abilities and improve ADLs. There are many simple exercises patients can perform to improve their ADL functionality. Some exercises only require body weight such as isotonic and isometric exercises, and others may require minimal equipment, such as a resistance band, for isokinetic exercises.

9.2 Assessing Mobility

This section identified key factors that affect mobility. Internal factors such as changes due to aging and medical conditions should be combined with external factors such as climate and housing structure. A comprehensive mobility assessment includes ROM, posture, gait, balance, and strength measurements to gather data about a patient's mobility status. Limitations in mobility can affect multiple body systems, so improving mobility and educating patients on the importance of mobility is essential for healthy living.

9.3 Transferring Patients

Safe patient handling includes techniques in transferring, lifting, and ambulating patients using assistance from nurses, equipment, devices, and proper body alignment. Patient transfers that are poorly managed are associated with higher fall rates, morbidity, mortality, and healthcare worker injury. A variety of devices, ranging from sling transfers and sliding boards to gait belts and crutches, are available for patients who are weight-bearing or non-weight-bearing or have an impaired gait, muscle weakness, joint problems, or injury. Nurses should use a step-by-step process to gather their supplies and equipment, clearly communicate, guide the patient through all the steps of the movement, and monitor the patient for pain or adverse symptoms. Patient education should include safety measures, maneuver instructions, and signs and symptoms to report to the nurse. Clear communication during patient transfer can ensure patient safety and prevent healthcare worker injury.

9.4 Positioning in Bed

A patient who is immobile in bed for long periods of time is at risk for musculoskeletal complications due to reductions in muscle mass and bone mineral density, improper body alignment, and impairment of other body systems. Equipment and devices, such as specialty mattresses, are designed to offload pressure from pressure points in the body and eliminate friction and shear. Specialty boots and wedges, as well as mattresses and repositioning techniques, relieve and distribute pressure throughout the body and aid in alignment. Common patient positions include prone, lateral, supine, and Fowler's. Nurses should educate patients and families about the various devices available to provide comfort for the patient. Collaboration with physical and occupational therapists is also beneficial as their expertise is in function and mobility.

9.5 Limited Movement Devices

A bone or soft tissue injury may warrant limiting mobility in a joint or limb. The limitation of movement allows the body to repair the injury without the risk of re-injury, complications, or further damage. Common types of devices include casts, braces, slings, bandages, skeletal traction, and external fixation. Each device has its own appropriate indications when treating injury. Nurses should be proactive in caring for these patients, and provide targeted assessments to recognize and prevent complications.

In certain situations, restraint use may be necessary. Restraints can be physical or chemical. The nurse should always ensure that the least restrictive measure is used, the restraint is used properly, frequent assessments are completed to prevent complications, the environment remains safe for the patient and staff, and the restraint is discontinued as soon as possible. Alternatives such as patient diversion, pain relief, and diversionary techniques can reduce the need for restraints, especially in long-term care settings.

Key Terms

abduction rotating out and away from the body
abductor pillow a pillow that keeps the hips in a neutral position to avoid external rotation and adduction
active ROM range of movement performed independently by the patient
active-assisted ROM a procedure performed with partial assistance from an external force; the patient is able to perform the ROM exercise but may need additional assistance when they encounter pain or weakness
activity of daily living (ADL) a routine task of everyday life necessary for independent self-care
adduction movement close to the midline of the body
adipose tissue body fat
aerobic exercise any cardiovascular activity that increases a patient's heart rate and respiration rate
alternating pressure mattress a mattress that is powered with air and can be programmed to inflate and deflate certain sections in a programmable cycle
balance state of equilibrium
balance exercise a movement to reduce the risk of falls among patients by focusing on body alignment and control
bandage a strip of material that can be used for slings, to hold splints in place, provide support for the limb or joint, or restrict movement
basic ADL an activity to manage basic needs such as toileting, dressing, bathing, eating, and ambulating
cane a singular assistive device that aids in balance when walking or helps compensate for an injury or disability
cast a splint that is set around the limb
chemical restraint any drug that is used to manage a patient's behavior in order to reduce the safety risk to the patient or others
congenital abnormality an impairment of body function or structure present at birth
coordination organization of different elements of the complex body, including muscular, skeletal, and sensory functions, to enable the elements to work together effectively
crutches an aid used for standing, walking, and mobility for patients who cannot support the weight of their bodies with their leg, knee, or ankle
external factor an environmental or social factor that contributes to immobility
external fixation fixation of a fracture where pins and wires are inserted into the bone percutaneously and held together externally
fibrous connective tissue a type of tissue that protects, supports, and holds bones, muscles, organs, and other tissues within the body in place
foam mattresses a mattress made of crosscut foam that allows parts of the mattress to shift along with the patient's body
foot drop syndrome the inability to raise the front part of the foot due to weakness and paralysis of the muscles that allow the foot to lift and maintain itself in a perpendicular position
functional brace a casting that is applied to areas of the limb, leaving the joint free
functional status a measurement of a patient's ability to perform physical movements (e.g., walking, standing) and higher-level activities (e.g., ADLs, filling occupational and societal roles)
gait a manner of walking or moving on foot
gait belt a strap placed around a patient's waist to help nurses assist with mobility and transfers
gel overlay mattress a mattress made with a combination of foam and gel; it conforms to the patient's body and retains less body heat
immobilization device any device, including casts, braces, slings, traction, and external fixation, that keeps a part of the patient's body in a fixed position
instrumental ADL a complex activity that keeps patients independent in the community, such as managing medications, preparing food, and managing household chores
internal factor a factor that affects mobility that is specific to each individual and may impact an individual's mobility in different ways
isokinetic exercise a resistance-based exercises that provide variable resistance to a movement
isometric exercise a movement related to contractions of specific muscles or group of muscles and then their release
isotonic exercises a movement that require muscles to resist constant weight over a range of motion

low air loss mattress a mattress that delivers active therapy by pushing air through tiny holes on the surface of the mattress to keep the skin dry, wick moisture, and accommodate pressure points. It is attached to an air pump or compressor that maintains inflation
mobility the ability of a patient to change and control their body position
non-weight-bearing a situation in which an affected limb or limbs cannot support any weight
orthostatic hypotension a temporary drop in blood pressure when moving from a supine position to a sitting or standing position
passive ROM range of motion performed when a patient is unable to move or not permitted to move a body part
peristalsis the wavelike movement of the gastrointestinal system to move contents forward
physical restraint any manual, physical, or mechanical device, material, or equipment attached to or adjacent to the patient's body that the individual cannot remove easily and restricts movement or normal access to one's body
podus boot a device used in foot drop syndrome that covers the ankle and foot to support the muscles, immobilize joints, and correct positioning
posture a fundamental mechanism to ensure balance against gravity, aligning the body, and assisting in external environmental perception and action
proprioception the body's ability to sense movement, action, and location of parts of the body
range of motion (ROM) the extent to which a part of the body can be moved around a joint or a fixed point
repositioning changing the position of a patient
restraint any measure, physical or pharmacological, that prevents or reduces the full movement of the patient during hospital care
skeletal traction the use of pins wires, or screws inserted distally from the fracture of the bone to create traction by attaching a string and weight
sliding board a piece of equipment that is flat and rigid, and creates a bridge for transfers; used for patients who cannot complete a transfer between two surfaces or if a standing transfer is not safe
sling a device used to support an upper limb by limiting movement or immobilizing the arm to prevent movement in the wrist, elbow, or shoulder
sling transfer a patient transfer from a bed, wheelchair, toilet, or shower using a lift machine and flat piece of material placed under the patient
specialty mattress a mattress designed to relieve pressure over bony prominences to prevent injury
splint a firm support that can be made of metal, plastic, or plaster
stand and pivot a technique for patients, who can partially weight-bear, by moving from sitting to standing and then just turning with one leg to sitting again
strength the quality or state of being strong
strength exercise a movement focused on increasing the maximum amount of force a muscle can exert
stretching movements to lengthen muscles
therapeutic exercise an intentional movement to develop strength, endurance, and increased range of motion and flexibility
traction the process of pulling on a broken bone or dislocated part of the body, in a slow and steady manner, to realign and stabilize it into the proper position
venous stasis a decrease in venous return to the heart
vestibular function the body's ability to compensate in response to self and external forces and keep balance
walker an aide for ambulation and transfers that has four points of contact with the ground
wedge pillow a large triangular pillow made of foam that elevates different parts of the body
weight-bearing the ability of a patient to put all their weight on a specific limb that is recovering from injury

Assessments

Review Questions

1. A patient is being discharged from the unit to home. When assessing the patient's ability to perform ADLs, you use the Katz Index of Independence in Activities of Daily Living. What patient assessment does this scale include?
    a. how they manage weekly grocery shopping

b. their ability to get mail at the end of the driveway
c. how they get dressed in the morning
d. their ability to prepare three meals daily

2. A nurse is preparing to give a patient a bed bath. The patient is a paraplegic and does not have any sensation or movement from their hips through their lower extremities. What is the most important action related to the patient's ADLs?
a. The patient should independently wash their upper extremities.
b. Family members in the room should be asked to assist.
c. The nurse should delegate this task to the patient care technician.
d. The bed should be raised to a height that is comfortable for the nurse.

3. A patient is trying to remember the exercises given by the physical therapist. The nurse knows the patient understands what an isokinetic exercise is when a patient states what?
a. "I need to perform ten squats while holding onto a railing for balance."
b. "I use soup cans at home to lift overhead five times for three sets."
c. "I have a red band that I hold in front of my chest and pull apart ten times."
d. "I squat ten times and at the bottom, I hold the position for ten seconds."

4. A nurse is conducting a mobility assessment on an 89-year-old female. What issue would most likely negatively affect mobility?
a. a recent move from a skilled nursing facility to an assisted living facility
b. a recent diagnosis of Parkinson disease
c. a need for a denture refitting
d. a new prescription for antibiotics for ten days

5. The nurse is assessing ROM on an older patient who is admitted after a fall at home. The patient reports having calf pain when they flex their leg. What is the nurse's best action?
a. Ask the patient to massage the area and flex it again.
b. Ask the patient to extend the leg and rotate his ankle instead.
c. Ask the physical therapist to assess and compare the patient's legs.
d. Ask the patient if the area is red and check for swelling.

6. You are assisting another nurse with the transfer of a patient from a bed to a chair using a sling lift. What would warrant you to stop the transfer process and educate the nurse?
a. The nurse explained the procedure to the patient.
b. The nurse brought in a sling from a different lift machine.
c. The nurse made sure the area was free of any obstacles.
d. The nurse asked the patient for consent before beginning the procedure.

7. A patient with a hip fracture is transferring from bed to stretcher to go to radiology. What piece of equipment is most appropriate for this transfer?
a. gait belt
b. Hoyer lift
c. sliding board
d. stand and pivot

8. A patient is being discharged home and is using a wheeled walker to ambulate. What statement demonstrates patient understanding of using the walker?
a. "I have to make sure the brakes are on when I stand up with the walker."
b. "I can use this walker to get up the front stairs."
c. "I will store the walker in my closet when I am not using it."
d. "I can walk on the brick sidewalks in my neighborhood."

9. What situation will most likely cause a patient who recently had hip surgery to develop a musculoskeletal complication?
   a. The patient is repositioned laterally without an abductor pillow.
   b. The specialty mattress is a gel overlay instead of an air mattress.
   c. Three side rails of the hospital bed are up, preventing movement.
   d. The head of the bed is raised to 45 degrees.

10. What is the purpose of a podus boot for patients with foot drop?
   a. to keep the foot plantarflexed
   b. to provide an active ROM exercise
   c. to keep the foot dorsiflexed
   d. to prevent pressure injuries

11. When educating a caregiver on positioning of a patient who is bedbound, what information is most important?
   a. The patient must start in the prone position when using a turning schedule.
   b. The caregiver should medicate the patient before every two-hour turn.
   c. Pillows should be used to relieve pressure from areas of the body.
   d. The head of the bed should always have a 45-degree angle or greater.

12. You are caring for a 75-year-old patient who keeps getting out of bed without calling and has an increased risk for falls. You've reinforced the importance of calling for help multiple times with the patient. What is an appropriate next step to ensure your patient remains safe?
   a. Ask the physician to order a vest restraint.
   b. Tie a sheet across the patient's lap so they can't get out of bed.
   c. Place a bed exit alarm under the patient.
   d. Give the patient Ativan so they fall asleep.

13. A patient was placed in violent restraints during the previous shift, because they were having a psychotic episode. As the oncoming nurse, you understand which statement is not true?
   a. Orders for violent restraints are good for six hours.
   b. A patient sitter must be in the room while the patient is in violent restraints.
   c. Assessment of the patient should be completed every fifteen minutes.
   d. The patient will be released from restraints as soon as the violent episode has passed.

14. A patient just had a cast placed on their arm to treat a radial fracture. They state that they are experiencing unrelieved pain and numbness in the fingers on the affected side. What intervention should be a priority for the nurse?
   a. elevating the extremity
   b. notifying the provider for cast removal
   c. applying ice to the extremity
   d. performing frequent neurovascular checks

15. You walk into the room of your patient in skeletal traction and find them slouched down to the foot of the bed with the traction weights on the floor. What education needs to be provided to the patient regarding skeletal traction?
   a. Let the patient know that the weights can be placed on the bed for comfort.
   b. Teach the patient how to keep their foot on the rail of the bed to relieve pain.
   c. Reinforce to the patient that the weight has to be freely hanging in order to keep proper bone alignment while healing.
   d. Tell the patient that they will be restrained if they continue to behave that way.

Check Your Understanding Questions

1. Explain the difference between isotonic and isometric exercises.

2. What is the difference between assessing a patient's ADLs and IADLs?
3. Your patient Marty is being discharged from the hospital after a chronic obstructive pulmonary disorder exacerbation. They have a walker and wheelchair at home from a previous hospitalization and want to know when they should use them. Marty has upcoming medical appointments and needs to walk around their apartment. What information will you give Marty about the wheelchair and walker?
4. What are the differences between a low air loss mattress and an alternating pressure mattress?
5. Describe interventions that you can do to prevent restraint use in a confused patient.

Reflection Questions

1. A home care patient has an exercise plan created by the occupational therapist. This plan was written for daily exercises and includes isometric exercises and bodyweight isotonic exercises. You are the nurse that is visiting today and the patient states, "I don't want to do the exercises today. They are too hard, and I don't see how it is helping me." What interventions would the nurse use to encourage the patient to perform the assigned exercises?
2. The nurse walks into a patient's room and sees that they are practicing physical therapy exercises. They have a red and purple band on their table. As the nurse looks at their plan of care, they see that the plan indicates isokinetic exercises. The patient is standing performing shoulder raises with two-pound dumbbells. What education does the nurse need to provide the patient?
3. Lonnie is 65 years old, resides alone in an urban area that is not safe at night, and lives slightly above the poverty line. In addition, Lonnie uses the public bus system and shops for groceries once a month. During the week they may go to a drugstore to buy snacks and frozen meals. On their last medical visit, Lonnie was diagnosed with congestive heart failure and hearing loss. Give examples of internal and external factors that might impact Lonnie and their mobility.
4. Your patient, Rajendra, is a 16-year-old high school sophomore who runs the 400 m and 800 m on the track team. Rajendra is recovering from an ankle joint fracture and is newly using crutches. What obstacles may Rajendra face on his first day returning to school?
5. When sitting a patient who is immobile in a chair, what are some high-pressure areas you would have to ensure had proper cushioning to prevent pressure injury?
6. Describe how you would assess a patient's limb with a cast. What signs or symptoms would indicate there was a problem?

Critical-Thinking Questions about Case Studies

1. Refer to Unfolding Case Study #2: Part 4.
   How would you respond when the patient requests placement of a urinary catheter instead of having to ambulate to the bathroom?
2. Refer to Unfolding Case Study #2: Part 5.
   Why are older adult patients at higher risk of falls?

What Should the Nurse Do?

A nurse is caring for an 89-year-old male who has been in the hospital for five days for a urinary tract infection. The patient has been given IV antibiotics and is improving. You walk into the room and notice that the patient is more alert and oriented today compared to his admission and states that he is feeling better. The patient says they can ambulate with a walker and assistance and asks to go to the bathroom. Up to now, they have been using a urinal. You notice in his chart that this would be the first time the patient would ambulate since their admission.

1. What questions may the nurse consider to ensure patient safety?
2. The patient came in as a "high" fall risk. He was confused, agitated, and would frequently try to get out of bed. Now, the patient is pleasant, alert, and oriented x4. What should the nurse include in her routine assessment?
3. How would you respond to the patient if they insisted on getting out of bed, but there is no order for

ambulation with assistance?

You are conducting a home health visit for Terrence, who lives alone at home. Terrence has visiting nursing services because of lower extremity wounds. Terrence is a 37-year-old male who weighs approximately 550 lbs (250 kg) and has limited mobility. He can ambulate 10 ft (3 m) before becoming short of breath. When observing the wounds, you see that the skin around one of the wounds is hot, red, and painful. His vital signs are within normal limits except for his blood pressure (170/90) and pulse (120). The patient has had two recent hospitalizations. One was six months ago for osteomyelitis, and the other was two months ago for pneumonia.

4. What are some factors that are affecting Terrence's mobility?
5. Which major body systems are being impacted by Terrence's limited mobility?
6. You are a nurse in the intensive care unit and your patient is scheduled for a CT scan of their abdomen. Your patient weighs 250 pounds (113 kg) and cannot assist with a transfer from the bed to the transport stretcher. What would be the safest way to transfer the patient to the stretcher?

Competency-Based Assessments

1. The Katz ADL Index is very useful in creating a common language about patient function for all healthcare practitioners involved in overall patient care planning and discharge planning. Using the Katz ADL Index (https://openstax.org/r/77KatzIndex) assess your peers, friends, or family members to increase competency when completing functional assessments.
2. Pair up with another person and teach them how to properly walk with a cane.
3. Choose a partner and practice placing each other in common patient positions, including supine (back), Fowler's (supine, head of the bed raised), orthopneic (tripod pose), prone (stomach), lateral (side-lying), and Sim's (semiprone). Discuss what feels comfortable or uncomfortable, what parts of the body feel like pressure points, and what you can do to relieve the pressure during position changes.
4. Review the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 10

Specimen Collection and Lab Testing

FIGURE 10.1 Nurses play a pivotal role in specimen collection, ensuring accurate and compassionate patient care through their expertise in the art and science of collecting diagnostic samples. (credit: modification of work "22-0001-126 (7013663)" by U.S. Army Photo by Spc. Logan Ludwig/Flickr, Public Domain)

CHAPTER OUTLINE

10.1 Urine Specimen
10.2 Stool Collection
10.3 Sputum Collection
10.4 Blood Sampling

INTRODUCTION As you embark on your educational journey to becoming a nurse, you will quickly discover that effective clinical care relies on not only compassionate patient interactions but also the acquisition of critical clinical skills. One of the foundational components of nursing practice is specimen collection. This chapter explores the collection and handling of various clinical specimens, including urine, stool, sputum, and blood. Mastery of these skills is critical, as accurate specimen collection is the first step in generating valuable diagnostic data that inform patient care decisions.

This chapter delves into the rationale behind each type of specimen collection, its clinical significance, and its role in identifying and managing a wide range of medical conditions. Proper techniques for collecting specimens are explored, emphasizing the importance of hygiene, patient communication, and safety throughout the process. These are foundational skills that lay the groundwork for your future nursing practice in providing high-quality patient care.

10.1 Urine Specimen

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the physical, chemical, and microscopic characteristics of urine
- Verbalize the steps in collecting a urine specimen
- Interpret the results of a urine analysis

Clinical nursing practice relies on the comprehensive understanding of urine specimens, encompassing the physical, chemical, and microscopic features of this diagnostic testing. This information is vital for identifying potential health issues, conducting accurate assessments, providing effective patient care, and developing treatment plans based on the specific characteristics observed in the urine samples. This chapter not only explores these fundamental characteristics but also guides you through the meticulous process of urine specimen collection, emphasizing the importance of precise technique and patient-centered care. Equally vital is the skill of interpreting urine analysis results, which enables nurses to translate findings into actionable insights for optimal patient care.

Urinalysis Overview

A **complete urinalysis** examines the physical, chemical, and microscopic composition of a sample of urine. A visual analysis of the urine describes the physical appearance of the urine. Physical characteristics include the color and **turbidity** (cloudiness) as well as the presence or absence of particles and the odor.

Chemical analysis of the urine involves placing a special test strip, called a **dipstick**, into the urine. The dipstick contains chemically infused pads on the strip that change color when certain substances are present in the urine. The color on the dipstick is compared with a color table that was provided with the test packaging that indicates what the different colors on the dipstick mean. Dipstick testing can be used to assess the pH level (acid-base level), urine specific gravity (concentration of solutes), as well as a variety of substances in the urine, such as protein (such as albumin), ketones (spill into urine when the body has to break down fats for energy), glucose (sugar), bilirubin (yellow pigment produced by the liver that is found in bile), nitrites (indicative of bacterial presence), and leukocyte esterase (white blood cells).

Microscopic analysis of the urine involves looking at drops of concentrated urine under a microscope to evaluate the presence of various cellular and noncellular components. It can be used to see if there are physical traces of foreign particles, such as crystals, bacteria, yeast, red or white blood cells, or **urinary casts** (small particles shaped like a tube that may contain different types of cells or substances). The microscopic analysis is typically performed in conjunction with a routine urinalysis, which includes the physical and chemical tests.

Purpose

A urinalysis is a valuable diagnostic tool for healthcare professionals to assess various aspects of health, including monitoring of certain health conditions (such as diabetes, kidney disease, and liver disease) and diagnosing urinary tract infections. Gradual changes in urine composition over time or big jumps to values outside of the normal ranges are potential cues that can alert the provider to further investigate the body systems and how they are working.

Types of Urine Collection

There are several types of urine sample collection methods, each suited to specific purposes or medical requirements. The choice of method depends on the clinical or diagnostic need. The following are common types of urine sample collections:

1. A **clean-catch urine sample** is the most common method of urine collection. The patient is asked to start urinating into the toilet, stop briefly, and then continue urinating into the container. This is done to avoid contamination of the sample with initial stream urine and any bacteria around the urethral opening. It is often used for routine urinalysis, culture and sensitivity testing, and other general diagnostic purposes.
2. A **twenty-four-hour urine collection** involves collecting all urine produced over a twenty-four-hour period. The collection typically starts after the first voided morning urine and ends with the first voided morning urine on the following day. It is used for tests that require measurement of substances excreted over an extended period, such as creatinine clearance, protein excretion, or hormone levels.
3. The **first morning void (FMV) sample** is used for some tests. The first urine voided in the morning is usually

more concentrated, making it suitable for some specific tests, such as pregnancy tests and for monitoring hormone levels.

4. A **timed urine collection** may be ordered. For this, urine is collected at specific times throughout the day, typically for several hours or even a full day. It is used for tests that require monitoring of substances or metabolites at different points in time, such as glucose tolerance tests.
5. To obtain a **catheterized urine sample**, a catheter is inserted into the bladder to obtain a urine sample directly from the bladder. This method is employed when a clean sample is necessary, especially if the person cannot provide one through normal voiding, such as in cases of urinary retention or surgery.
6. The method of **suprapubic aspiration** is invasive and involves using a needle and syringe to aspirate urine directly from the bladder through the abdominal wall. It is used in specific cases where other methods are not feasible or sterile samples are required, such as in infants or when a catheter cannot be used.
7. A **pediatric collection device** may be used. For infants and young children who are not yet toilet-trained, a urine collection bag or adhesive pediatric collection device can be used. These devices adhere to the child's genital area to collect urine. Care must be taken to ensure a clean and uncontaminated sample.
8. A **random urine sample** is collected at any time without specific timing or preparation. It can be used for a variety of tests but is often less reliable compared to clean-catch or timed samples.

LINK TO LEARNING

How to collect a urine sample from an indwelling Foley catheter (https://openstax.org/r/77UrSamFoleyCat) is demonstrated in this video.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Obtaining a Urine Specimen from a Foley Catheter

See the competency checklist for Obtaining a Urine Specimen from a Foley Catheter. You can find the checklists on the Student resources tab of your book page on openstax.org.

Procedural Steps for Urine Collection

To collect a clean-catch or midstream urine sample, you need a sterile urine collection container and facility-approved antiseptic wipes or antiseptic solution. Start by washing your hands thoroughly with soap and water to prevent contamination of the sample. Identify the patient with name and date of birth, matching with patient verbally and checking ID bands. Preprinted labels should be verified too. Don gloves and prepare the collection container by opening the collection container lid. Use caution not to touch the inside of the container or the lid, as the inside of the container and lid should remain sterile. Set the container aside in a clean, convenient location, using caution that the inside of the lid does not touch any surface.

Ensure patient privacy and explain the procedure to the patient. Prepare the patient by cleaning the genitalia, which helps reduce the risk of contamination from the surrounding skin. If the patient has a vagina, spread the labia with your nondominant hand. With your dominant hand, cleanse the genital area using a facility-approved antiseptic wipe and wiping from front to back to prevent bacteria from entering the urinary meatus. Use one wipe to clean the right side of the genitalia, one wipe to clean the left side of the genitalia, and one wipe to clean down the middle. If the patient has a penis, use a circular motion to cleanse the tip of the penis, starting at the urinary meatus and working away from the urinary meatus. If the patient is not circumcised, retract the foreskin prior to cleansing the penis.

Before collecting the sample, ask the patient to urinate a small amount into the toilet to clear any potential contaminants from the urethra. Ask the patient to stop the urine stream and then hold the urine collection container in one hand and gently spread the labia for women or retract the foreskin for men to expose the urethral opening. Instruct the patient to restart the urine stream into the sterile container. Collect enough urine to fill the container to the level indicated on the collection container, which is typically around 30 to 60 mL or as specified. Instruct the patient to finish urinating into the toilet if needed, and then carefully cap the collection container without touching the inside of the lid. Label the collection container with the patient's name, date, time collected, and any other

requested information according to facility. After sealing the container, place the collection container in a biohazardous lab specimen bag, and wash your hands thoroughly again to ensure hygiene. Deliver the sealed urine sample container to the laboratory as instructed. The sample should be sent promptly to the lab or stored according to facility protocol if immediate testing is not possible.

LINK TO LEARNING

Learn how to collect a clean-catch urine sample (https://openstax.org/r/77CleanCatUrSam) in this video demonstration.

To perform a twenty-four-hour urine sample, the nurse will collect all urine produced by the patient for twenty-four hours. Typically, twenty-four-hour urine samples are started in the morning upon waking up. Instruct the patient to urinate upon waking up and discard the first morning urine. Note the exact time of the first morning urine, as this is the start time for the twenty-four-hour collection period. To ensure accurate results, it is crucial to document the start time of the twenty-four-hour collection period as well as the end time for the testing. Collect all urine passed for the next twenty-four hours, ensuring every drop of urine during this time is included in the collection.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Collecting a Twenty-Four-Hour Urine Specimen

See the competency checklist for Collecting a Twenty-Four-Hour Urine Specimen. You can find the checklists on the Student resources tab of your book page on openstax.org.

To collect the urine, the patient will void into a clean, plastic collection container that fits under the toilet seat (or a clean urinal may be used). The urine from the collection container or urinal will then be poured into a large, plastic container (Figure 10.2). It is important to collect all urine throughout the twenty-four hours, being careful that no urine spills. It is essential to avoid any contamination with water, toilet paper, bowel movements, or other foreign substances, as contamination may impact the test results. The twenty-four-hour urine container should be kept cold throughout the twenty-four-hour window. Typically, the container is put on ice at the patient's bedside in healthcare settings. It is critical to replace the ice as necessary to ensure the urine remains cold. If the twenty-four-hour urine container fills up, keep the full container on ice and obtain another container from the laboratory. Once the twenty-four-hour marker has been reached, instruct the patient to void one last time, adding the urine to the collection container. Clearly label the container with the patient's name, date of birth, start and end times of the collection, and any other information requested by the facility's policies. Transport the sample to the lab as soon as possible for accurate results, ensuring the sample remains cold during transport.

FIGURE 10.2 Twenty-four-hour urine containers are usually larger than typical urine sample containers, with a larger capacity to hold all urine produced in a day. (credit: modification of work "Trace_metal-free_24_hour_urine_container.jpg" by Unknown/Wikimedia Commons, CC BY 4.0)

Documentation of Urine Collection

Proper documentation of urine collection is a crucial aspect of patient care, as it helps maintain the integrity of samples, ensures patient safety, and provides a clear record of the collection process for future reference. It also aids in tracking and tracing samples in case of any issues or disputes. For instance, accurate recording of the start and end times is crucial when a patient is undergoing a twenty-four-hour urine collection to assess kidney function. In cases where there may be concerns or disputes about the collected sample, perhaps the start and end times are not noted on the sample container, detailed documentation can become a valuable reference for tracking and tracing the collection times. The first step of documentation is to verify the patient's identity by checking their identification band and asking for their name and date of birth to verify the sample was collected from the correct patient. Document the date and time of urine collection, type of urine sample collected (e.g., clean-catch sample, twenty-four-hour collection), any relevant patient information (e.g., patient's complaints or symptoms), and special instructions or comments (if applicable). Some electronic medical record systems may have specific forms or templates for urine collection documentation.

Document the transfer of samples to the laboratory, if required. If the sample needs to be stored before testing or if there are specific storage requirements, document these instructions clearly in the medical record as well. Document any unexpected events, deviations from the standard procedure, or patient reactions during the urine collection process. Before leaving the patient or completing the documentation, review all the information to ensure accuracy and completeness. Ensure that all documentation complies with institutional, legal, and privacy regulations governing healthcare records.

Patient Education

Patient education is a critical component when performing a urine sample collection. Providing clear and thorough instructions to the patient helps ensure the accuracy and reliability of the sample and contributes to a positive patient experience. Be sure to include the following:

- Explain why the urine sample is necessary.

- Note the specific type of urine sample required (e.g., clean-catch sample, twenty-four-hour collection) and why it is needed for the patient's diagnosis or treatment.
- Describe the collection procedure and what they can expect throughout the process. If the patient will be collecting the urine sample independently, additional instructions will be needed to ensure the patient can accurately perform the procedure.

Encourage the patient to ask questions if they have any doubts or concerns. Make sure they understand the instructions fully before they start the collection. If necessary, explain when and how the patient will receive the results of the urine sample and any subsequent actions required. Offer written instructions or a handout summarizing the key points for the patient to reference as needed.

Clear and patient-centered communication is essential in ensuring that the patient understands the urine sample collection process, which, in turn, enhances the quality and reliability of the sample. It also contributes to a positive patient experience and cooperation during the procedure.

Interpretation of Results

Interpreting a urine analysis involves analyzing the results of various tests performed on a urine sample to assess a person's health. The interpretation of urinalysis results can provide valuable insights into various aspects of an individual's health, including kidney function, hydration status, and the presence of certain medical conditions. To correctly interpret the results, the nurse must be aware of normal findings, abnormal findings, and factors that affect the results.

Normal Findings

Normal urine is yellow, clear, and has a mild odor. Other normal findings of a urinalysis are listed in Table 10.1. While these findings are considered "normal," it is important to note that urine composition can vary among individuals based on factors such as age, diet, hydration status, and overall health. What may be considered "normal" for urine findings in one age group or life stage may differ from another. For example, infants may have different norms for urine color and chemical content compared to adults. Additionally, changes in kidney function, metabolism, and other physiological factors associated with aging can impact urine characteristics in older adults. Health conditions more common in certain age groups may also influence urine test results. As a result, healthcare professionals take these variations into account when interpreting urine findings, recognizing that what is considered normal can differ across different age groups and life stages.

Physical Examination	
Color	Yellow (light/pale yellow to amber)
Turbidity	Clear
Odor	Mild, slightly ammonia-like odor
Chemical Examination	
pH	4.5 to 8.0 (pH of 7 is neutral, >7 is alkaline, <7 is acidic)
Specific gravity	1.005 to 1.030
Glucose	Negative
Blood	Negative
Ketones	Negative

TABLE 10.1 **Normal Urinalysis Findings** (Source: Queremel Milani & Jialal, 2023.)

Protein	Less than or equal to 150 mg/day or 10 mg/dL
Urobilinogen	0.1 mg/dL to 1 mg/dL in random samples or up to 4 mg/daily
Bilirubin	Negative
Nitrites	Negative
Leukocyte esterase	Negative
Microscopic Examination	
Red blood cells	Zero to five cells/high-power field
White blood cells	Zero to five cells/high-power field
Eosinophils	Absent
Squamous epithelial cells	Less than or equal to fifteen to twenty cells/high-power field
Crystals	Absent
Bacteria, fungi, yeast, or parasites	Absent
Casts	Absent

TABLE 10.1 Normal Urinalysis Findings (Source: Queremel Milani & Jialal, 2023.)

Abnormal Findings

Abnormal findings include urine that is colorless, red, orange, dark yellow, or brown, cloudy, or foul smelling. Other abnormal findings are listed in Table 10.2.

Physical Examination	
Color	Colorless (indicates diluted sample), red (may be secondary to blood, certain foods, or medications), blue or green (may be secondary to certain foods, medications, or bacteria), orange (may be secondary to bile pigments, certain foods, or medications), dark yellow (concentrated sample, may indicate dehydration), or dark brown/tea colored (may be secondary to bile, certain foods, or medications)
Turbidity	Cloudy (indicates the presence of suspended particles, such as cells, crystals, or bacteria)
Odor	Foul (may indicate infection), fruity (may indicate diabetic ketosis), strong (may indicate dehydration), fecal (may indicate fistula)
Chemical Examination	
pH	Less than 4.5 (acidic; may indicate dehydration, diabetes, diarrhea) or greater than 8 (alkaline; may indicate old sample, hyperventilation, vomiting)
Specific gravity	Less than 1.005 (may indicate the urine is dilute/too much water) or greater than 1.030 (may indicate the urine is concentrated/not enough water)

TABLE 10.2 Abnormal Urinalysis Findings (Source: Queremel Milani & Jialal, 2023.)

Glucose	Greater than 1,000 mg/dL (may indicate diabetes, gestational diabetes, Cushing syndrome)
Blood	Present (may indicate kidney issues or muscle trauma)
Ketones	Present (may indicate uncontrolled diabetes, pregnancy, starvation)
Protein	Greater than 150 mg/day, or 10 mg/dL (may indicate congestive heart failure, strenuous exercise, kidney or pregnancy issues, or fever)
Urobilinogen	Less than 0.1 mg/dL or greater than 1 mg/dL in random samples, or greater than 4 mg/daily (may indicate liver disease, antibiotic use)
Bilirubin	Present (may indicate liver dysfunction)
Nitrites	Present (may indicate urinary tract infection [UTI])
Leukocyte esterase	Present (may indicate inflammation)
Microscopic Examination	
Red blood cells	Greater than zero to five cells/high-power field (may indicate UTI or inflammation)
White blood cells	Greater than zero to five cells/high-power field (may indicate UTI or inflammation)
Eosinophils	Present (may indicate UTI or kidney issues)
Squamous epithelial cells	Greater than fifteen to twenty cells/high-power field (may indicate contamination, UTI)
Crystals	Present (may indicate acidic or alkaline urine, decreased urine output)
Bacteria, fungi, yeast, or parasites	Present (may indicate contamination, UTI)
Casts	Present (may indicate various kidney disorders)

TABLE 10.2 Abnormal Urinalysis Findings (Source: Queremel Milani & Jialal, 2023.)

REAL RN STORIES

Confusion Can Mean a Urinary Tract Infection

Nurse: Liu
Clinical setting: Medical-Surgical Inpatient Unit
Years in practice: 7
Facility location: Utah

I was working on a medical-surgical unit when I received a call from the lab about urine lab results for one of our

patients, Mrs. Anderson, a 72-year-old female who had been admitted with confusion. The lab reported several urinary abnormalities, including the presence of white blood cells, traces of blood, and elevated levels of nitrites in her urine. These findings raised concerns about a potential urinary tract infection (UTI), which is a common health issue in older adults and can result in confusion, or if untreated can lead to complication of urosepsis.

I notified the provider with the results. The provider started Mrs. Anderson on an antibiotic treatment to target the suspected UTI. Additionally, I emphasized the importance of increased fluid intake and proper hygiene to support her recovery. Over the next few days, we closely monitored Mrs. Anderson's condition and her response to treatment. Her symptoms gradually improved, and follow-up urine lab results indicated a reduction in white blood cells, nitrites, and blood in her urine, suggesting that the UTI was resolving.

Factors Affecting Results

Urinalysis results may be affected by a variety of factors, including diet, medications, medical conditions, and contamination. What an individual eats and drinks can impact urine composition (Table 10.3).

Factor	Alteration of Urinalysis
Dehydration	Concentrated urine, affects specific gravity
Extended exposure to light	Decomposes urobilinogen and bilirubin
Extended periods at room temperature	Encourages bacterial growth
Contamination	False-positive infection or alters pH level
Alkaline pH	False positive for protein
Glucose	Decrease in the sample pH
Contrast	False-positive specific gravity
Certain foods and drugs (including food coloring, blackberries, red beets, rhubarb, phenytoin, rifampicin, ibuprofen, chloroquine, deferoxamine, nitrofurantoin, metronidazole, phenolphthalein, phenothiazines, and imipenem/cilastatin)	Alterations in urine color, odor, or pH value

TABLE 10.3 Factors That Can Affect Urinalysis Results (Source: Queremel Milani & Jialal, 2023.)

Other factors that affect urinalysis results include exercise, menstrual cycles, and pregnancy. Vigorous physical activity can lead to dehydration, which may affect urine concentration. For persons with ovaries, menstrual blood can sometimes contaminate a urine sample, causing false-positive results for **hematuria**, or blood in the urine. Pregnancy can affect urine composition, leading to changes in protein levels, glucose, and other parameters.

There are also factors associated with the collection procedure to consider. Urine composition can vary throughout the day. For example, the first morning urine sample may be more concentrated, while urine collected later in the day may be more dilute. Proper collection techniques may also impact the results. For example, the results of a twenty-four-hour urine collection may be impacted by forgetting to collect all of the urine, going beyond the twenty-four-hour time limit, losing some of the urine due to spilling or overflow, or not keeping the urine cold. Proper handling and storage of the urine sample are crucial. To ensure accurate urinalysis results, it is essential to consider these factors and take them into account when interpreting the data. Additionally, healthcare providers may use a combination of tests and clinical information to arrive at a comprehensive diagnosis when evaluating a patient's health based on urinalysis results.

10.2 Stool Collection

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the chemical, physical, and microscopic characteristics of stool
- Verbalize the steps in collecting a stool specimen
- Interpret the results of a stool specimen

In the ever-evolving field of health care, comprehensive knowledge and proficiency in nursing skills are critical for providing high-quality patient care. One fundamental aspect of patient assessment and diagnosis revolves around understanding the intricacies of feces both as a diagnostic tool and as a reflection of an individual's gastrointestinal health. The solid waste product that is expelled from the body through the rectum and anus during the process of defecation is called **feces** (also commonly referred to as stool or bowel movements). This section delves into the essential aspects of the chemical, physical, and microscopic characteristics of stool. You also learn how to accurately collect a stool specimen to send for analysis. Nurses must be able to interpret the results of a stool sample, equipping them with the expertise needed to make informed clinical decisions and deliver the best possible care to patients.

Stool Specimen Overview

A **stool specimen**, also known as a fecal specimen or fecal sample, is a sample of feces (solid waste) collected from a person for laboratory analysis. Components of stool specimen analysis include chemical analysis, physical characteristics, and microscopic examination.

Chemical analysis of stool involves the laboratory examination of a stool sample to assess its composition and detect specific substances or markers that can provide valuable diagnostic information about a person's gastrointestinal health. Stool samples may be analyzed for various chemicals, including fat, carbohydrates, and enzymes, to assess digestive function and nutrient absorption.

Chemical analysis may be used to detect blood, measure the amount of fat in the stool, identify the presence of reducing substances, measure stool pH, assess stool urobilinogen, assess stool bile acids, and assess stool nitrogen content.

Physical assessment of stool involves the visual and sensory examination of stool characteristics, including color, consistency, shape, odor, mucous, undigested food particles, parasites or worms, and blood. The physical characteristics of stool provide information about gastrointestinal health, and abnormalities in these characteristics may indicate digestive disorders.

Microscopic assessment of stool involves examining a stool sample under a microscope to identify and evaluate various components, including cells, microorganisms, and particles. Cultures may be performed to identify specific pathogens, such as bacteria, viruses, parasites, or fungi.

Purpose

Stool specimens are commonly used in clinical diagnostics to evaluate various aspects of gastrointestinal health and to detect the presence of certain diseases or conditions. For example, stool specimens are often collected to diagnose infections, inflammatory bowel disease (IBD), and malabsorption disorders. Stool samples may also be used to detect infections caused by bacteria, viruses, parasites, and fungi that can affect the digestive tract. Common examples include bacterial gastroenteritis, *Clostridium difficile* infection, and intestinal parasitic infections. Stool specimens may be collected at various points during treatment to assess the effectiveness of therapies, such as antibiotics for bacterial infections or antiparasitic medications. They may also be examined for the presence of **occult blood** (hidden blood), which may indicate gastrointestinal bleeding from conditions like ulcers or colorectal cancer, and to provide insights into digestive function, including the presence of pancreatic enzymes and the ability to absorb certain nutrients.

Types of Stool Collection

There are several types of stool collection methods, each designed for specific diagnostic purposes. The choice of stool collection method depends on the clinical need and the type of analysis required. Common types of stool sample collections include **random stool sample**, **three-day stool collection**, **fecal occult blood test (FOBT)**, **stool**

culture, **stool for ova and parasites (O&P)**, **stool fat test** (fecal fat test), and **stool for *Clostridium difficile* (*C. diff*) toxin**. Descriptions of each can be found in Table 10.4.

Type of Stool Collection	Description of the Collection Method
Random stool sample	A single stool sample collected at any time without specific timing or preparation. It is often used for routine tests, such as checking for the presence of blood or infectious agents in the stool.
Three-day stool collection	For some tests, a healthcare provider may request stool samples collected over a period of three consecutive days. This method can help detect intermittent problems or infections that may not be present in a single sample.
Fecal occult blood test (FOBT)	This test is used to detect small amounts of blood in the stool, which may be indicative of gastrointestinal bleeding. The sample is typically collected on special cards or slides.
Stool culture	A stool culture is used to identify and isolate specific bacteria or pathogens causing gastrointestinal infections. A fresh stool sample is collected and sent to a laboratory for bacterial culture.
Stool for ova and parasites (O&P)	This test is used to identify the presence of parasites or their eggs in the stool, such as *Giardia* or *Entamoeba histolytica*. Multiple stool samples may be collected on different days for accurate diagnosis.
Stool fat test (fecal fat test)	This test measures the amount of fat in the stool and is used to diagnose malabsorption disorders, such as celiac disease or chronic pancreatitis. It may involve collecting stool samples over a twenty-four- to seventy-two-hour period while on a specific diet.
Stool for *Clostridium difficile* (*C. diff*) toxin	This test detects the presence of *C. difficile* toxins in the stool and is used to diagnose *C. difficile* infection, especially in cases of antibiotic-associated diarrhea.

TABLE 10.4 Types of Stool Collection

Procedural Steps for Stool Collection

Properly collecting a stool sample is crucial for accurate test results and contamination prevention. To prepare, gather necessary supplies, explain the procedure to the patient, and ensure privacy. Identify the patient with name and date of birth, matching with patient verbally and checking ID bands. Preprinted labels should be verified too. Wear gloves, place a collection device in the toilet, and instruct the patient to avoid water contact during sample collection. Advise against placing toilet paper in the container. Collect a walnut-sized stool portion, avoiding urine contamination. Securely close and label the container with patient details, date, and time. Dispose of any used plastic wrap, clean the toilet, remove gloves, and wash hands thoroughly.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Collecting a Random Stool Sample

See the competency checklist for Collecting a Random Stool Sample. You can find the checklists on the Student resources tab of your book page on openstax.org.

CLINICAL JUDGMENT MEASUREMENT MODEL

Generate Solutions: Recognizing Potential Contamination of a Stool Sample

The nurse is collecting a stool sample from a plastic collection device that was placed underneath the toilet seat. While collecting the sample, the nurse notes a small amount of yellow liquid in the plastic container (recognizing cues). Provided the plastic collection container was placed under the toilet seat, the nurse realizes that urine may have accidentally gotten in the collection container. The nurse asks the patient if they urinated during the collection process, which the patient confirmed they had (analyzing cues). The nurse suspects the stool was contaminated with urine (prioritize hypotheses) and decides the sample needs to be recollected (generate solutions).

For the collection of a stool sample to test for occult blood, gather a **fecal occult blood card** (card containing a testing area that changes color when it comes into contact with blood), gloves, and an applicator stick or brush. Follow the same procedures for collecting a stool sample; however, use the applicator stick or brush to collect a small sample of stool from different areas of the bowel movement. Occult blood is not typically equally dispersed throughout the stool; therefore, taking samples from different areas of the bowel movement increases the chances of identifying blood that may be present. Follow the instructions in the kit for how many samples to collect and where to collect them. Avoid urine contamination and transfer the collected stool samples onto special test cards. Seal the test cards according to the kit's instructions. This may involve folding the card or attaching a special sticker. Label the sample with the patient's name, date of birth, date, time, and any other information requested on the test card or container label. Clean up, dispose of gloves, and wash hands. If you are working in a facility where nurses apply the fecal occult developer solution to the card, allow the specimen to dry for three to five minutes. Open the reverse side of the card and apply two drops of fecal occult developer solution to each square. A blue reaction will occur within sixty seconds if the test is positive. The absence of a blue color after sixty seconds is considered a negative test.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Collecting a Fecal Occult Blood Test and Hemoccult Card

See the competency checklist for Collecting a Fecal Occult Blood Test and Hemoccult Card. You can find the checklists on the Student resources tab of your book page on openstax.org.

Transport the sample following the instructions provided by the healthcare facility's protocols. Some samples may need to be refrigerated during transport, while others can be stored at room temperature. Prompt delivery to the laboratory is essential for accurate results. The specific instructions for collecting stool samples may vary depending on the test and healthcare provider's requirements. It is essential to follow the provided instructions carefully to ensure the accuracy and reliability of the test results.

Documentation of Stool Collection

Documenting a stool sample is essential for maintaining accurate records and ensuring proper tracking of the sample throughout the diagnostic process. Proper documentation helps healthcare providers and laboratory personnel to associate the sample with the correct patient, record relevant information, and interpret results correctly.

Document the date and the time when the stool sample was collected. Indicate the specific stool collection method used, such as a random sample, twenty-four-hour collection, or FOBT. Document any other relevant details, such as any unusual characteristics of the stool. If the stool sample collection required special instructions, such as dietary restrictions or medication adjustments, make sure these instructions are documented clearly. Note if the sample was difficult to collect or if there were any issues during the collection process.

Patient Education

Many medications can alter the results of stool tests; therefore, patients may need to avoid certain medicines prior to the stool testing. Patients should be educated to stop taking medicines such as antacids, antidiarrheal medicines,

antiparasitic medicines, antibiotics, laxatives, or nonsteroidal anti-inflammatory drugs (NSAIDs) for one to two weeks before stool testing. For example, antacids may alter the pH of the stool, which may affect the chemical reactions of the testing, leading to false-negative occult blood testing or decreased detection of bacteria. NSAIDS may cause changes in stool consistency (diarrhea) and gastrointestinal irritation that may result in false-positive occult blood testing.

If the patient is self-collecting the stool sample, they should be educated on the proper procedure for collecting the sample and how to store the sample once it is collected. Patients should be instructed to ensure the stool is not mixed with urine, toilet paper, or any other contaminants. It is important to educate the patient on the importance of collecting a fresh sample, keeping the sample in a cool, dry place (not in the refrigerator), and returning the sample to the laboratory as soon after collection as possible. If the sample is being tested for blood, instruct the patient to avoid the test if they have active bleeding or it is during their menstrual cycle, as these may lead to a false-positive result. Patients should also be instructed to avoid red meats for three days prior to testing, as the blood from the meat can cause a false-positive test result.

PATIENT CONVERSATIONS

Educating Patients on How to Collect a Stool Sample

Nurse: Good morning, Mr. Hall. Your provider has ordered a stool sample to see if we can figure out what is causing your stomach pain. I'm here to provide you with some instructions on how to collect the stool sample and will guide you through the process.

Patient: Good morning. I appreciate your help. I've never done this before, so I'm a bit unsure about how it all works.

Nurse: That's completely understandable, Mr. Hall. First, this is the stool collection kit [shows the kit to the patient]. It contains everything you need. Here, we have a collection container, a wooden stick, and a pair of disposable gloves [shows each item to the patient as the item is identified].

Patient: Okay, what do I do with those items?

Nurse: First, you will put on the disposable gloves. This is to ensure neither your hands nor the sample get contaminated with stool. Next, place a piece of plastic wrap under the toilet seat to catch the stool. This makes it easier to collect the stool without any contact with urine or toilet water. When you're ready to have a bowel movement, pass the stool onto the plastic wrap. Then use the wooden stick to scoop the stool into the collection container. You only need a small amount, about the size of a walnut, so you don't have to fill the container to the top. It is important, though, to collect the sample while it's still fresh and be sure not to put the toilet paper in with the stool. Remove your gloves, turning them inside out to avoid contact with the stool.

Place the lid tightly on the collection container, place the container into the provided plastic bag, and seal it tightly.

Patient: That doesn't seem too hard. What do I do once I've collected the sample?

Nurse: Once you've collected the sample and securely packaged it in the plastic bag, please label the bag with your name, birth date, date of collection, and the time the sample was collected. Store the sample in a cool, dry place until you bring it to the lab. Ideally, it should be taken to the lab as soon as possible for accurate testing. Make sure not to refrigerate the sample unless specified by your healthcare provider.

Patient: I appreciate you walking me through what to do. This makes the process seem much less intimidating.

Nurse: I'm glad I could help, Mr. Hall. If you have any more questions or concerns as you go through this process, please don't hesitate to reach out. We're here to assist you every step of the way.

Interpretation of Results

Interpreting stool test results involves analyzing the data obtained from various laboratory tests performed on a stool sample. The interpretation is done by healthcare professionals, such as gastroenterologists, pathologists, or primary care physicians, in the context of the patient's medical history, symptoms, and clinical presentation.

Interpretation of stool test results should always consider the entire clinical context, including the patient's symptoms, medical history, physical examination, and other diagnostic tests. Depending on the findings, further tests and evaluations may be recommended to determine the underlying cause of any abnormalities and to develop an appropriate treatment plan.

Normal Findings

Normal stool should appear brown, soft, well-formed in consistency, and shaped like a tube. It should have a stool-like odor due to the bacteria in the gut; however, it should not be overpowering. Normal stool should not contain blood, mucus, pus, undigested meat fibers, harmful bacteria, viruses, fungi, or parasites. However, undigested food particles in stool may be normal in some circumstances, especially after consuming certain foods like corn or seeds.

A normal FOBT result is negative, indicating the absence of occult (hidden) blood in the stool. A normal fecal fat test shows minimal to no fat content in the stool, indicating the individual is efficiently digesting and absorbing dietary fats. Minimal or no reducing substances should be present in the stool, indicating efficient carbohydrate digestion and absorption. The stool pH should fall within a normal range which can vary but is typically slightly acidic or neutral, reflecting normal gastrointestinal function. A normal stool urobilinogen level is present, indicating the normal metabolism of bilirubin in the intestines. Normal levels of bile acids are found in the stool, suggesting proper bile production and flow.

Under the microscope, normal stool should contain a minimal number of white blood cells (leukocytes) (indicating the absence of significant inflammation or infection in the gastrointestinal tract) and no red blood cells (erythrocytes) (indicating the absence of gastrointestinal bleeding). Epithelial cells from the lining of the gastrointestinal tract may be present but in small quantities. Normal stool may contain some bacteria, predominantly the normal gut flora, which includes various types of bacteria. Yeast cells or fungi should be rare. Stool samples are typically negative for parasites. Normal stool may contain a minimal amount of fat, but fat should not be present in large quantities (which suggests efficient fat digestion and absorption).

Abnormal Findings

Abnormal stool may be black (may indicate upper gastrointestinal bleeding or iron supplement ingestion), red (may indicate lower gastrointestinal bleeding), white (may indicate liver or biliary disorders), yellow (may indicate malabsorption of fats), or green (may indicate infection or malabsorption). It may be watery or loose (diarrhea) or hard, dry pellets (constipation) (Figure 10.3). Stools that are thin in shape may indicate a narrowing in the colon (which may indicate colon cancer). Foul-smelling stools can result from certain infections, malabsorption, or dietary factors. Odor changes may indicate an underlying issue. Increased mucus production or visible mucus may be associated with conditions like irritable bowel syndrome (IBS) or IBD. Persistent undigested food in stool could indicate malabsorption or gastrointestinal disorders.

The Bristol Stool Scale			
Type 1	**Severe constipation**	Separate hard lumps, like nuts (hard to pass)	
Type 2	**Mild constipation**	Sausage-shaped but lumpy	
Type 3	**Normal**	Like a sausage but with cracks on the surface	
Type 4	**Normal**	Like a sausage or snake, smooth and soft	
Type 5	**Lacking fiber**	Soft blobs with clear-cut edges	
Type 6	**Mild diarrhea**	Fluffy pieces with ragged edges, a mushy stool	
Type 7	**Severe diarrhea**	Watery, no solid pieces; entirely liquid	

FIGURE 10.3 The Bristol Stool Scale is a medical tool used to classify the form of human feces into seven categories, ranging from type 1 (hard, separate lumps) to type 7 (entirely liquid). (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Abnormal stool may contain blood, mucus, pus, undigested meat fibers, harmful bacteria, viruses, fungi, or parasites. The presence of visible blood in stool (**hematochezia**) or occult blood (hidden blood) may indicate gastrointestinal bleeding, which can have various causes, including ulcers, hemorrhoids, or colorectal cancer. Hematochezia is often associated with **melena**, which is dark, tarry stools, often associated with upper gastrointestinal bleeding. The dark color results from the digestion of blood as it travels through the digestive system. Melena is considered a medical emergency and requires prompt evaluation and intervention by healthcare professionals.

Abnormal chemical assessments of the stool may also help to identify gut health. A positive FOBT result indicates the presence of occult blood in the stool, which may suggest gastrointestinal bleeding. Blood noted in the stool should be immediately reported to the provider for further evaluation. Elevated levels of fat in the stool (**steatorrhea**) are abnormal and may suggest malabsorption disorders, such as celiac disease, chronic pancreatitis, or conditions affecting fat digestion and absorption. Elevated levels of reducing substances (carbohydrates) in the stool are abnormal and may suggest carbohydrate malabsorption or lactose Intolerance. Stool pH that is consistently highly acidic or alkaline may be abnormal. Elevated levels of urobilinogen in the stool may be abnormal and may suggest liver disease or other conditions affecting bilirubin metabolism. Elevated levels of bile acids in the stool may be abnormal, indicating malabsorption disorders or problems with the biliary system.

When the stool is examined under the microscope, elevated numbers of white blood cells (leukocytes) in stool may indicate inflammation, infection, or certain gastrointestinal disorders. The presence of red blood cells (erythrocytes) can be a sign of gastrointestinal bleeding. Abnormal microorganisms, such as pathogenic bacteria, *Clostridium difficile* (*C. difficile*) spores, or excessive yeast/fungi, may be present (which may indicate infections or imbalances in the gut microbiome). Detection of parasites like *Giardia*, *Entamoeba histolytica*, or other pathogenic parasites is abnormal. Abnormally high numbers of fat globules (steatocytes) in the stool may suggest malabsorption disorders, such as celiac disease, chronic pancreatitis, or fat digestion issues.

Abnormal assessment findings of stool may require further evaluation by a healthcare provider, often involving additional tests and diagnostic procedures to identify and address underlying gastrointestinal issues or diseases. Interpretation of these results should be done in the context of the patient's clinical history and presentation.

Factors Affecting Results

Stool test results can be influenced by various factors, including the patient's diet, medications, underlying medical conditions, and even the timing of the sample collection. It is essential to be aware of these factors, as they can

impact the accuracy and interpretation of stool test results (Table 10.5).

Factor	Affecting Result
Medications, such as anticoagulants, colchicine, nonsteroidal anti-inflammatory medicines (NSAIDs), iron preparations, corticosteroids, and phenylbutazone	May irritate the gastric mucosa and cause a positive occult blood result
Antibiotics	Can alter the gut microbiome
Vitamin C	Can cause a false-negative occult blood result
Constipation (prolonged exposure to intestinal bacteria)	May not show trypsin activity
Red meat, certain fruits (apples, bananas, cantaloupe), and vegetables (broccoli, cauliflower, radishes, and turnips)	Can cause a false-positive occult blood result
Specimen contamination (urine, water, toilet paper)	Compromises the integrity of the sample

TABLE 10.5 Interfering Factors Affecting Stool Results (Source: Martin, 2023.)

The timing of sample collection can be critical for certain stool tests. For example, for FOBTs, samples collected during menstruation or immediately after gastrointestinal bleeding may yield false-positive results. Incorrect handling, storage, or transportation of stool samples can introduce contamination and affect the integrity of the sample. Inadequate or improper collection techniques can lead to inaccuracies in stool test results.

To ensure the accuracy and reliability of stool test results, it is essential to follow specific instructions provided by healthcare providers or laboratories. Additionally, healthcare providers should consider the patient's clinical history and any influencing factors when interpreting stool test results and making diagnostic and treatment decisions.

10.3 Sputum Collection

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the chemical, physical, and microscopic characteristics of sputum, nasal secretions, and throat cells
- Verbalize the steps in collecting sputum, nasal, and oropharyngeal specimens
- Interpret the results of sputum, nasal, and oropharyngeal specimens

Sputum, nasal, and throat analyses offer valuable insights into the respiratory health of our patients, aiding in the diagnosis and management of a wide range of conditions. Understanding the chemical, physical, and microscopic characteristics of sputum, nasal secretions, and throat cells provides a foundation for recognizing abnormalities. As a nurse, you will be responsible for collecting sputum, nasal, and oropharyngeal specimens, ensuring accurate and contamination-free sampling. By knowing the normal characteristics of sputum, nasal secretions, and throat cells, you will be able to interpret the results of specimen testing, enabling you to make informed clinical decisions and deliver the best possible care to your patients.

Sputum, Nasal, and Throat Specimen Overview

Mucus and other secretions that are coughed up from the lungs and expectorated through the mouth are called **sputum**. The body normally produces mucus to keep the delicate tissues of the respiratory tract moist so small particles of foreign matter can be trapped and forced out. Sputum can exhibit various chemical, physical, and microscopic characteristics that are valuable for diagnostic purposes. These characteristics can provide important insights into the patient's respiratory health.

Nasal and oropharynx specimens are most commonly used for the detection of pathogenic microorganisms in the nose and throat. The oropharynx is the part of the throat at the back of the mouth behind the oral cavity. It includes the back third of the tongue, the soft palate, the side and back walls of the throat, and the tonsils. Microscopic examination of nasal and oropharynx swabs are used to detect the presence of microorganisms, such as bacteria, fungi, or parasites.

Purpose

A sputum culture is a diagnostic test that evaluates the type and number of bacteria present in sputum. The patient is asked to cough deeply and spit any mucus that comes up into a sterile specimen container. The sample is sent to a lab where it is placed in a special dish (Figure 10.4) and watched for two to three days or longer to see if bacteria or other disease-causing germs grow.

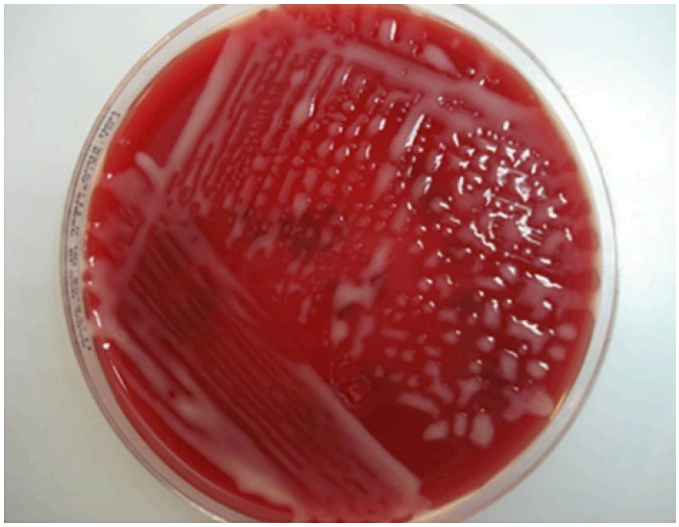


FIGURE 10.4 This is an example of a sputum culture growing in a petri dish. (credit: modification of work by National Library of Medicine, CC BY 3.0)

Sputum cytology is also a critical component of a lung cancer diagnosis. It involves examining sputum samples for the presence of abnormal or cancerous cells and can help detect lung cancer at an early stage. It can also be used for diagnosis of chronic respiratory conditions such as chronic obstructive pulmonary disease (COPD) or asthma, and performed periodically to monitor disease progression and guide treatment. Sputum samples can also be collected before and during treatment for respiratory conditions to help assess the effectiveness of therapy.

Nasal and oropharyngeal swabs are commonly used to diagnose respiratory infections, including viral infections like COVID-19, influenza, the common cold, and bacterial infections such as streptococcal infections (strep throat). By collecting samples from the upper respiratory tract, healthcare providers can detect the presence of pathogens responsible for these infections. The specific purpose of the swab test may vary depending on the clinical context and the suspected pathogen. For example, the COVID-19 swab test, which uses a nasopharyngeal or oropharyngeal swab, is used to detect the presence of SARS-CoV-2, while an oropharyngeal swab is used to identify *Streptococcus* bacteria.

Types of Sputum, Nasal, and Oropharyngeal Collections

There are several methods for collecting sputum samples for diagnostic and clinical purposes, each depending on the specific diagnostic goals and the patient's condition. Some common types of sputum collection methods include the following:

- In **spontaneous sputum collection**, the patient coughs up sputum and spits it into a sterile container.
- In **induced sputum collection**, a hypertonic saline or other aerosolized agent may be used to induce sputum production in cases where the patient has difficulty producing sputum. The patient inhales the agent, which loosens mucus and makes it easier to cough it up for collection.
- In **nasotracheal suction collection**, a nasotracheal suction catheter may be used to collect sputum directly from the lower respiratory tract in patients who are unable to produce sputum or when deeper respiratory samples are required. This method is typically used in more critical or ventilated patients.

- In **bronchoscopy collection**, an invasive procedure, a thin, flexible tube with a camera is inserted into the airways. During this procedure, a healthcare provider can collect sputum samples from specific areas within the respiratory system for diagnostic purposes.
- A **sputum trap** may be used in some cases. Healthcare facilities may use this specialized collection device that attaches to the patient's breathing equipment (such as ventilators) to collect sputum samples.

There are several methods for collecting nasal and oropharyngeal specimens for diagnostic and clinical purposes. Some common types of nasal and oropharyngeal collection methods include the following:

- For a **nasal swab**, a swab is used to collect a sample from the inside of the nasal passage.
- For a **nasopharyngeal swab**, a swab is used to collect a sample from the nasopharynx, which is the upper part of the throat that connects to the back of the nasal cavity.
- For an **oropharyngeal swab**, a swab is used to collect a sample from the oropharynx, which is the part of the throat at the back of the mouth.

Procedural Steps for Sputum, Nasal, and Oropharyngeal Collection

Prior to implementing sputum specimen collection, it is helpful to ensure the patient is well hydrated. Hydration helps thin and loosen sputum and increases the likelihood of obtaining an adequate sample. If the patient is prescribed nebulizer treatments, it is helpful to administer this treatment prior to the procedure to help mobilize secretions. It is also important to assess if the patient is experiencing pain related to coughing. For example, pain following chest or abdominal surgery can inhibit the patient from taking deep breaths and expectorating. In this case, pain medication should be provided prior to performing the procedure. Patients can also be encouraged to support surgical wounds with a pillow while coughing to provide additional support and comfort.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Collecting a Sputum Specimen

See the competency checklist for Collecting a Sputum Specimen. You can find the checklists on the Student resources tab of your book page on openstax.org.

It is best to obtain sputum samples in the early morning because secretions accumulate overnight. The patient can rinse their mouth with water prior to the procedure, but avoid mouthwash or toothpaste because these products can affect the microorganisms in the sample. Remove dentures if they are present.

Be aware that droplets and aerosols may be generated when collecting sputum specimens, so use appropriate personal protective equipment when entering the room and during the procedure based on the patient's condition. Explain the procedure to the patient, the type of specimen required, and the difference between oral secretions and sputum. Identify the patient with name and date of birth, matching with patient verbally and checking ID bands. Preprinted labels should be verified too. Position the patient in a seated position in a chair or at the side of the bed or place them in high Fowler position.

Instruct the patient to take three slow, deep breaths and then cough deeply. Repeat this process until the patient has produced sputum, with rest periods between each maneuver.

When the patient has mobilized sputum, instruct them to expectorate directly into a sterile specimen container without touching the inside or rim of the container. The specimen should be at least 5 mL (one teaspoon); ask the patient to continue producing and expectorating sputum until this amount is achieved. Assess the sputum specimen to ensure it is sputum and not saliva. Sputum appears thick and opaque, whereas saliva appears thin, clear, and watery.

Cap the specimen container tightly, and ensure it is labeled with the patient's name. Place the specimen in a transport bag, and send it to the laboratory for analysis. Document the time and date the sputum specimen was collected and the characteristics of the sputum, including amount and color.

If a patient is unable to expectorate a sputum sample, other interventions may be required to mobilize secretions. It is often helpful to collaborate with a respiratory therapist for assistance in this situation. Interventions may include

nebulizers, hydration, deep-breathing exercises, chest percussion, and postural drainage. If these interventions are not successful, a sputum sample may be obtained via oropharyngeal or endotracheal suctioning; these methods are used to obtain sputum samples for patients who are intubated.

When performing a nasal swab, gently insert the sterile swab into the patient's nostril (Figure 10.5) (Centers for Disease Control and Prevention [CDC], 2022). The swab should be directed upward and backward along the floor of the nasal passage, following the natural curvature of the nasal cavity. The swab should be advanced to a depth of about 1 to 1.5 in (2.5 to 4 cm). Rotate the swab gently for about ten to fifteen seconds to ensure that it comes into contact with the nasal mucosa, which contains the cells and secretions necessary for the test.

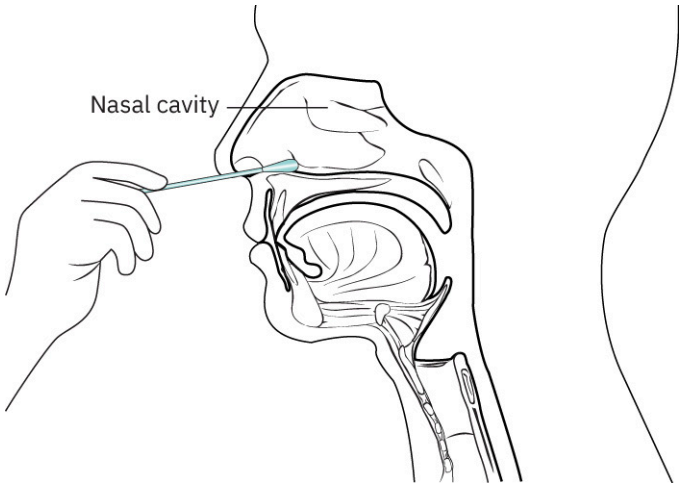


FIGURE 10.5 Nasal swabs are inserted into the nose to collect a specimen from the nasal passage. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

To collect a nasopharyngeal swab test, ask the patient to tilt their head slightly backward to help access the nasopharynx more easily. Remove the swab from the packaging. Gently insert the sterile swab through one of the patient's nostrils, and advance it approximately the distance equivalent from the ear to the nostril of the patient (Figure 10.5) (CDC, 2022). The swab should be directed posteriorly, following the natural curvature of the nasal passage. If you meet resistance, try reinserting the swab at a different angle or use the other nostril; however, do not force the swab.

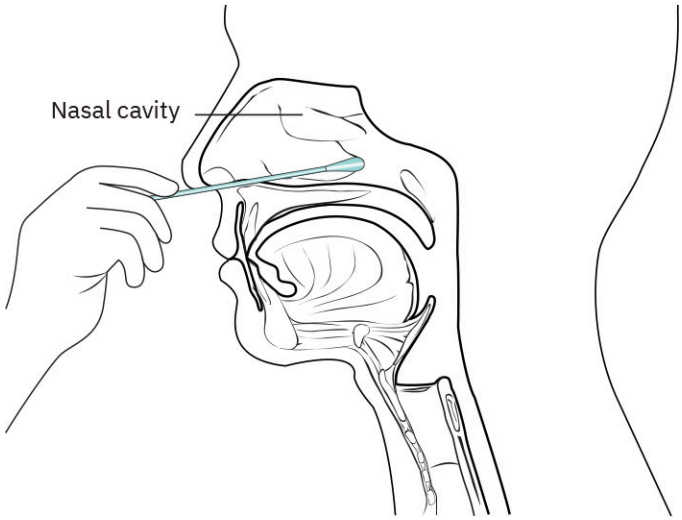


FIGURE 10.6 Nasopharyngeal swabs are inserted into the nose and advanced through the nasal passage to collect a throat specimen. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Once the swab has reached the nasopharynx, gently rotate it for several seconds to collect the sample. This may induce a gag reflex or cause mild discomfort, but it is usually brief. Slowly withdraw the swab while continuing to rotate it to ensure maximum sample collection. Carefully remove the swab from the nostril and place it in the sterile collection tube, according to manufacturer's guidelines. The swab should be inserted into the tube swab-first and

typically involves breaking the swab off at an etched groove so the lid can be placed on the tube. Properly label the container with the patient's identifying information, including the patient's name, date of birth, date and time of collection, and other details according to facility policy. Place the collection tube in a biohazard bag and transport the sample to the laboratory according to facility procedure.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Collecting a Nasopharyngeal Sample

See the competency checklist for Collecting a Nasopharyngeal Sample. You can find the checklists on the Student resources tab of your book page on openstax.org.

The procedure for collecting an oropharyngeal specimen is similar to collecting a nasopharyngeal specimen; however, the swab is inserted in the mouth and directed toward the back of the throat (Figure 10.7) (CDC, 2022). Instruct the patient to open their mouth and say "ahh." Avoid touching the tongue, teeth, and gums. Gently swab the back of the throat and the tonsils (if present). Ensure that the swab comes into contact with the oropharyngeal area for several seconds to collect an adequate sample. A tongue depressor may be used to hold the tongue down, if necessary, to better visualize the throat. Like nasopharyngeal testing, oropharyngeal testing may induce a gag reflex or cause mild discomfort; however, it is usually brief.

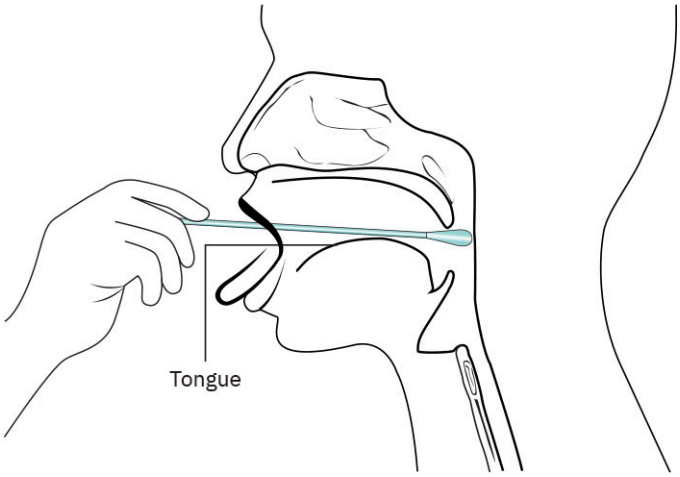


FIGURE 10.7 Oropharyngeal swabs are inserted into the mouth and advanced to the back of the throat to collect a throat specimen. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Documentation of Sputum, Nasal, and Oropharyngeal Collection

Documenting sputum, nasal, and oropharyngeal collections is an important part of the diagnostic process, as it helps ensure proper tracking and identification of samples, which is crucial for accurate diagnosis and treatment. Always follow the specific documentation procedures and guidelines set by the healthcare facility to ensure consistency and accuracy in the documentation process.

Documentation should include:

- type, date, time, and quality of the specimen
- recent antibiotic therapy
- appearance of the oral mucosal and/or nasal structures
- patient's tolerance of the procedure
- any unexpected outcomes or interventions
- teaching provided to the patient and family, including understanding of the teaching and any follow-up teaching needed

Patient Education

Patient education is a crucial part of sputum collection to ensure that the process is done effectively, comfortably, and with minimal risk of contamination. Be sure to cover the following:

- why sputum collection is necessary
- the ideal time for sputum collection, such as in the morning when sputum production is often highest
- the importance of refraining from eating or drinking for at least thirty minutes before collecting sputum to minimize saliva contamination
- good handwashing before collecting sputum
- proper use of the sputum collection container
- coughing technique
- importance of avoiding contaminating sputum with saliva

Inform the patient about when and how they will receive the results of their sputum analysis. If the patient has an infectious respiratory condition, explain the importance of good respiratory hygiene. Encourage patients to ask questions and seek clarification if needed to ensure they feel confident in the process. Provide contact information for questions or concerns.

Before performing a nasal or oropharyngeal swab on a patient, it is important to provide clear and reassuring instructions to help the patient understand the procedure, what to expect during the collection process, and alleviate any concerns. It is important to educate patients that retrieval of throat specimens may initiate a gag reflex. If gagging occurs, it will be brief. The patient should try to remain still, avoid pulling away, and take deep breaths through their nose.

Interpretation of Results

Interpreting sputum, nasal, and throat specimen results is a critical part of diagnosing and managing respiratory conditions and infections. Specimen analysis provides valuable insights into the nature of respiratory illnesses and can guide healthcare providers in making informed decisions regarding treatment and care. This section reviews normal and abnormal findings as well as factors affecting the results.

Normal Findings

When considering the normal findings of sputum, it is important to note that what is considered "normal" can vary among individuals. What may be considered "normal" for a healthy individual could be different from what is expected in the context of diagnosing or monitoring specific respiratory conditions. Normal sputum, in a healthy individual, should typically have no color or smell and should not contain blood or microorganisms (Table 10.6).

Characteristic	Result
Color	Clear, white, or slightly yellow
Consistency	Thin, watery
Odor	None
Volume	Small amount, not excessive
Clarity	Transparent or slightly cloudy
Viscosity	Not overly viscous or sticky
Blood	Negative
Microorganisms	Negative

TABLE 10.6 Normal Characteristics of Sputum

Normal findings in nose and throat specimens generally mean there are no signs of viral or bacterial pathogens. Normal nasal and oropharyngeal swabs will be negative for viruses (e.g., influenza, common cold viruses) or bacteria (e.g., *Staphylococcus aureus*, *Streptococcus pyogenes*) responsible for respiratory infections.

Abnormal Findings

Abnormal findings in a sputum sample indicate the presence of various respiratory conditions, infections, or other health issues. Characteristics of abnormal sputum can be found in Table 10.7.

Characteristic	Description
Color	Yellow or green (purulent) sputum often suggests a bacterial respiratory infection, such as bronchitis or pneumonia. Brown or rusty-colored sputum may indicate the presence of old blood. Red or pink sputum (hemoptysis) may suggest active bleeding in the respiratory tract, which could be caused by various conditions, including lung cancer, tuberculosis, or bronchitis.
Consistency	Abnormal sputum may be thick and sticky.
Odor	An unpleasant or foul odor in sputum can be indicative of a bacterial or fungal infection.
Volume	Sputum samples with an abnormally high volume of thick, sticky mucus may be observed in conditions like cystic fibrosis.
Clarity	Abnormal sputum may be cloudy.
Viscosity	Abnormal sputum may be viscous and sticky.
Presence of blood	Abnormal sputum may contain blood.
Presence of white blood cells (leukocytosis)	Elevated levels of white blood cells (leukocytes) in sputum are often indicative of an inflammatory response to infection or other respiratory conditions.
Presence of microorganisms	Identification of specific bacterial species in sputum may indicate bacterial respiratory infections like pneumonia or bronchitis.
Cytological abnormalities	The presence of abnormal or cancerous cells in sputum is a critical finding that may suggest lung cancer or precancerous changes.
Inflammatory cells	Elevated levels of eosinophils in sputum may be indicative of conditions like asthma or eosinophilic lung diseases. The presence of neutrophils and other inflammatory cells can help identify the nature of the inflammation and the underlying cause.
Crystals	Charcot-Leyden crystals found in sputum are often associated with eosinophilic inflammation and may be seen in conditions like asthma or parasitic lung infections.

TABLE 10.7 Abnormal Sputum Findings

It is important to note that sputum analysis is just one component of the diagnostic process. Abnormal findings in sputum are typically considered alongside the patient's clinical history, physical examination, imaging studies, and other tests to make an accurate diagnosis and guide treatment decisions.

Abnormal findings in nose and throat specimens generally mean there are signs of viral or bacterial pathogens. Abnormal nasal and throat swabs will show evidence of viruses (e.g., influenza, common cold viruses) or bacteria

(e.g., *Staphylococcus aureus*, *Streptococcus pyogenes*) responsible for respiratory infections.

Factors Affecting Results

There are a number of factors that can affect sputum results, influencing the characteristics of the sample and the accuracy of diagnostic information. Healthcare providers and laboratory professionals must be aware of these factors when interpreting sputum results:

- deviations from standard collection process
- inability to collect a quality sample
- contamination of the specimen
- patient compliance
- certain medications that can alter sputum
- certain foods that can alter the color of sputum
- underlying patient conditions or environmental exposures
- improper transport or storage of specimen

LIFE-STAGE CONTEXT

Factors Affecting the Results in Older Adults

Age-related factors can affect sputum results, particularly for older adults. For example, age-related changes in the respiratory system, such as reduced lung function and weakened cough reflexes, can impact sputum production. Therefore, older adults may have a harder time generating sufficient sputum for collection and may not have the physical strength to generate a productive cough. Sputum consistency also alters with increased age. Sputum from older adults may be thicker and more viscous due to age-related changes in mucous production and clearance mechanisms. Older adults are also more prone to respiratory conditions like COPD and pneumonia, which can affect sputum characteristics. For example, COPD often leads to increased mucous production, thicker and more viscous sputum, blood in the sputum, and changes to sputum color (such as yellow, green, or even brown).

Collecting a sputum sample from an older adult with cognitive impairments, such as dementia, can present several challenges. These individuals may have difficulty understanding instructions, following through with the procedure, or expressing discomfort. Older adults with cognitive impairments often have limited ability to cooperate during the sputum collection process and may not comprehend the need for the procedure or may resist it due to confusion or anxiety. Cognitive impairments can also lead to anxiety and agitation during unfamiliar medical procedures, which can make the sputum collection process distressing for the individual and challenging for healthcare providers. In many cases, caregivers or healthcare providers may need to assist with sputum collection to ensure the safety and comfort of the patient.

There are also several factors that can affect the accuracy and reliability of nasal and throat specimens. The way the specimen is collected, including the swabbing technique and the depth to which the swab is inserted, can significantly affect the results, as improper collection may result in inadequate sample retrieval or contamination. The timing of specimen collection in relation to the onset of symptoms can impact results, as some infections may not be detectable in the early stages of illness or may have already cleared by the time the test is performed. The choice of swab can affect the results, as the swab should be designed for the specific diagnostic test. Medications such as antibiotics and antivirals can impact the results. For example, if a patient has already started antibiotic or antiviral treatment, it may impact the ability to detect the pathogen in the sample. Understanding these factors is essential to ensure nasal and throat samples are collected and analyzed accurately.

10.4 Blood Sampling

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the chemical, physical, and microscopic characteristics of blood
- Verbalize the steps in collecting a blood specimen
- Interpret the results of a blood sample analysis

Nurses often obtain blood samples for testing, which is a common and essential component of patient care and diagnostics. As healthcare professionals, nurses understand that the quality and accuracy of these specimens are critical, as they hold the key to uncovering invaluable insights into a patient's health. Understanding the chemical, physical, and microscopic characteristics of blood provides a foundation for recognizing abnormalities. As a nurse, you will be responsible for collecting blood specimens, ensuring accurate and contamination-free sampling. Knowing the normal characteristics of blood provides nurses with a baseline to be able to interpret the results of blood testing, enabling the nurse to make informed clinical decisions for their patients.

Blood Specimen Overview

Blood is a term used to describe the liquid that moves through the vessels and includes plasma (the liquid portion, which contains water, proteins, salts, lipids, and glucose), the cells (red and white cells), and cell fragments called platelets. Blood **plasma** is actually the dominant component of blood and contains water, proteins, electrolytes, lipids, and glucose. Blood is 20 percent of a person's extracellular fluid and 8 percent of their weight. The four main components of blood are plasma, red blood cells, white blood cells, and platelets.

LINK TO LEARNING

More details about the composition and function of blood (https://openstax.org/r/77CompFuncBlood) are presented in this video.

Purpose

Blood collection serves multiple purposes in health care. It is a fundamental diagnostic tool used to gather valuable information about a person's health and medical conditions. Blood testing is used for a variety of things, including the following:

- diagnosing certain diseases and conditions
- monitoring a chronic disease or condition
- evaluating effectiveness of a treatment
- evaluating organ function
- diagnosing clotting or bleeding disorders
- evaluating the immune system

Types of Blood Collection

Nurses collect blood samples from patients using several methods, including venipuncture, capillary blood sampling, and blood draws from venous access devices. Blood may also be drawn from arteries by specially trained professionals for certain laboratory testing.

Venous

The process of **venipuncture** involves introducing a needle into a patient's vein to collect a blood sample or insert an intravenous (IV) catheter. Blood sampling with venipuncture may be initiated by nurses, phlebotomists, or other trained personnel. Venipuncture for collection of a blood sample is an important part of data collection to assess a patient's health status. It is commonly performed to examine hematologic and immune issues such as the body's oxygen-carrying capacity, infection, and clotting function. It is also useful for assessing metabolic and nutrition issues such as electrolyte status and kidney functioning. Venous blood is relatively easy to collect and is preferred because veins are superficial and have less nerves associated with them (Srikanth & Lotfollahzadeh, 2023).

Arterial

In **arterial blood sampling,** blood is obtained via puncture into an artery by specially trained registered nurses and other healthcare personnel, such as respiratory therapists, physicians, nurse practitioners, and physician assistants. Arterial blood collection is most commonly performed to assess the body's acid-base balance in a diagnostic test called an arterial blood gas. The most common access site for arterial blood sampling is the radial artery. Arterial blood tests are known to be more painful for the patient than venipuncture and have a higher risk of complications such as bleeding and arterial occlusion with subsequent ischemia to the area distal to the puncture.

Capillary

In **capillary blood collection**, blood is obtained from capillaries just beneath the skin's surface, often from the fingertips or heel (in infants). A **lancet** device is used to puncture the skin and collect a small drop of blood on a capillary tube, filter paper, or test strip. Capillary blood is frequently used for point-of-care (POC) testing, such as glucose monitoring for diabetes, as well as for newborn screenings. Capillary blood is ideal for POC and rapid tests because it is readily accessible; however, it may not provide the same depth of analysis as venous or arterial blood.

Procedural Steps for Blood Collection

For each type of blood collection, there is an associated procedure for collecting the blood sample. It is imperative for nurses to not only know how to demonstrate each type of blood collection method but also be skilled in selecting an appropriate site for collecting the blood sample. Understanding the factors that guide the choice of site selection is paramount to ensure the procedure's accuracy and the patient's comfort. This section equips you with the skills and knowledge to perform venous, arterial, central line, and capillary blood collections.

Venous Blood Collection

Performing a venipuncture involves selecting an appropriate site and placing a **tourniquet** (tightly tied band applied around a limb to temporarily constrict or restrict blood flow) several inches above the selected venipuncture site to slow the blood flow in the veins, making the veins more visible and accessible. Ensure the tourniquet is tight enough to engorge the veins without causing pain but not so tight as to impede arterial blood flow.

Clean the venipuncture site with an antiseptic agent and allow the site to completely air dry to avoid contaminating the sample. After informing the patient you are about to perform the venipuncture, puncture the vein quickly and smoothly. Once blood begins to flow, adjust the angle of the needle to be nearly parallel with the skin. Be cautious not to puncture through the vein. Release the tourniquet as soon as blood starts to flow, as prolonged use may alter blood chemistry. Fill the required amount of blood into the vacutainer(s) or syringe.

Once the required volume is obtained, withdraw the needle smoothly and gently. Apply pressure and a sterile adhesive bandage or gauze to the venipuncture site to stop any bleeding. Dispose of equipment in the appropriate receptacles, label the blood collection tube appropriately, and place the sample in a biohazard bag to send to the laboratory for analysis.

LINK TO LEARNING

Some helpful tips for drawing blood (https://openstax.org/r/77CompFuncBlood) are presented in this video.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Performing a Venipuncture

See the competency checklist for Performing a Venipuncture. You can find the checklists on the Student resources tab of your book page on openstax.org.

Vein Selection

Selecting an appropriate vein for venous blood sample collection is a critical step in ensuring a successful and comfortable procedure. Assess the patient's medical history and condition to check for any known issues or complications related to venous access, such as past difficulties in blood collection or potential vein-related conditions. Visually inspect the patient's arms, hands, and wrists to identify visible and palpable veins. Consider using the nondominant arm, but the choice may depend on patient preference or previous issues with blood collection. Look for veins that are straight, visible, and easily palpable, as these are typically easier to puncture and yield blood more readily. The antecubital fossa (the bend of the elbow) is a common site for venipuncture due to its accessibility and typically larger veins. Consider alternative sites, such as the back of the hand, the wrist, or the forearm, especially if the antecubital veins are not suitable.

Vein size and depth can vary significantly from person to person. Choose a vein that is of appropriate size for the

required blood volume and is not too deep so that the site can be punctured comfortably.

Veins that feel like they "bounce back" when gently pressed are often more suitable for venipuncture. Avoid selecting veins that show signs of damage, scarring, or thrombosis (clotting). Damaged veins may be more painful and less suitable for blood collection.

Communicate with the patient about their comfort and preferences regarding vein selection. Some individuals may have preferences based on past experiences or discomfort in certain areas. Be sensitive to any concerns the patient may have and try to accommodate their preferences, if possible. If the selected veins do not seem prominent enough, a warm compress may be applied to the area for a few minutes to help dilate the veins and make them more accessible.

REAL RN STORIES

Navigating the Art and Science of Vein Selection in Patient Care

Nurse: Nancy
Clinical setting: Emergency Department
Years in practice: 23
Facility location: California

I work as a nurse on the IV team. One evening, I received a call from the emergency department about a patient who had been admitted with a severe infection. The patient, Mr. Johnson, was in his late sixties and had a history of diabetes, which had resulted in multiple health issues. He was now dealing with a worsening cellulitis infection in his lower leg that needed urgent IV antibiotic therapy.

When I arrived at the emergency department to assess Mr. Johnson, it was clear that the situation was dire. The infection had spread significantly, and he was running a high fever. His veins were extremely challenging to access because his diabetes had caused considerable damage to his vasculature. I knew that selecting the right vein site was crucial for effective antibiotic delivery and to avoid complications. Mr. Johnson was already in a great deal of pain, and I wanted to make the process as comfortable as possible for him.

I began by gently explaining the situation to him and reassuring him that we would do our best to find an appropriate vein. I inspected his arms, hands, and wrists, looking for visible and palpable veins. After inspecting his arms and hands, I decided to use a vein in his forearm. While the vein was small, it was straight and the only palpable vein I could find. I made sure to use a smaller gauge needle to minimize discomfort.

It took a bit of time and patience, but I finally managed to secure the IV line. Mr. Johnson was incredibly grateful and told me how much he appreciated my approach and the care I had taken in selecting the vein. This experience highlighted the importance of not only clinical skill but also communication and empathy in nursing. Choosing the right vein site is not just a technical task; it is about ensuring the best possible care and comfort for the patient as well.

Collection Devices

Venous blood collection devices are tools and equipment used by healthcare professionals to collect blood samples safely and efficiently from a patient's vein. When collecting venous samples, you will need a needle, vacutainer, and vacutainer tubes. There are several different types of needles to pick from, including a **vacutainer needle** (a needle with a built-in vacutainer adapter), a **butterfly needle** (winged infusion set with a vacutainer attached), and a **multiple-draw needle** (needle that connects to a separate vacutainer prior to the collection tubes being attached) (Figure 10.8). Vacutainer needles come in various sizes, including 21-, 22-, and 23-gauge needles, and are attached to vacutainer tubes to draw blood directly into the tubes. Butterfly needles (winged infusion sets) are smaller and more flexible than standard needles and are often used for patients with difficult-to-access veins or those who require frequent blood draws. Multiple-draw needles allow multiple blood tubes to be collected sequentially without needing to remove the needle from the vein. This is a built-in safety feature to help avoid needlesticks.

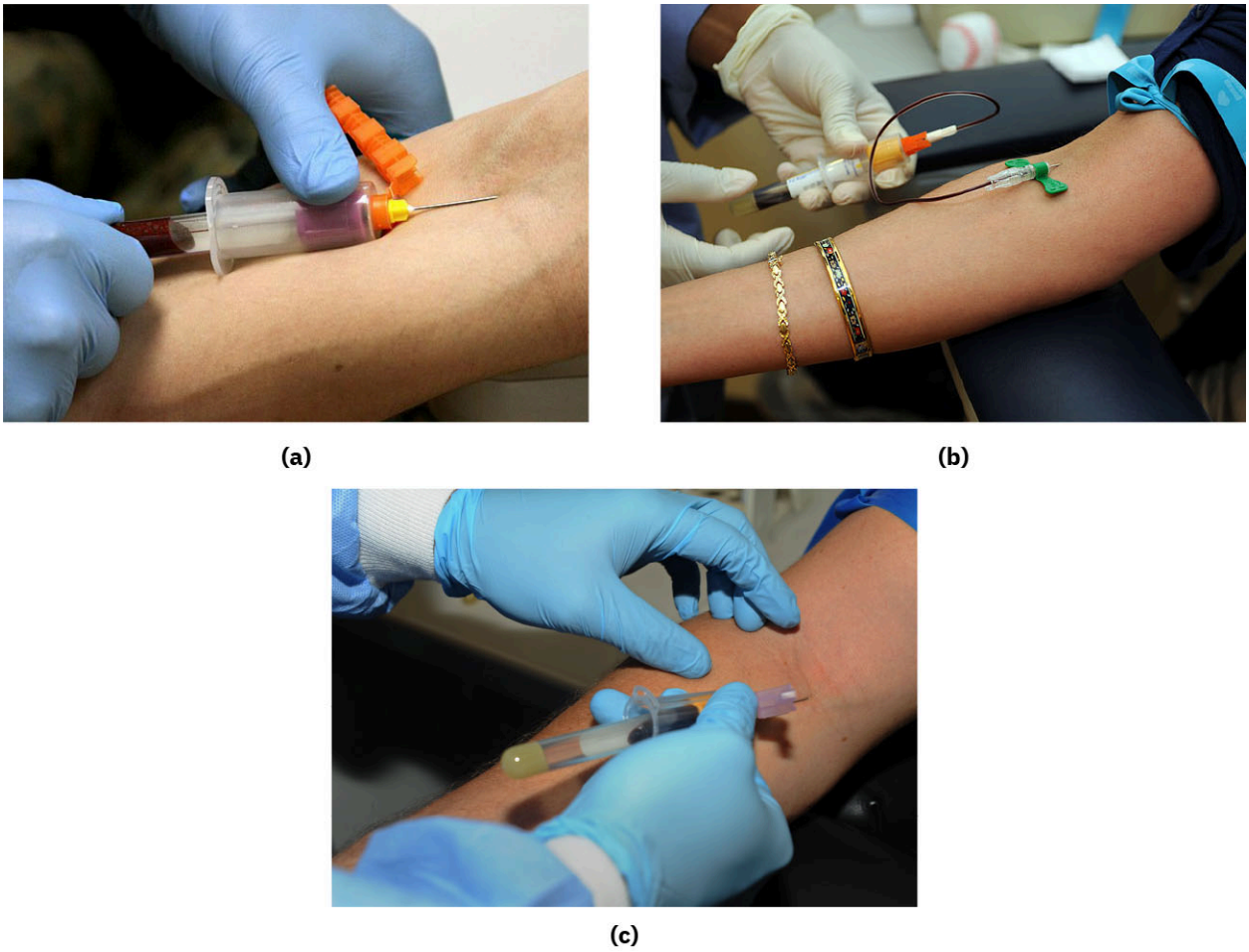


FIGURE 10.8 (a) Vacutainer needles, (b) butterfly needles (winged infusion sets), and (c) multiple-draw needles may be used to collect venous blood samples. (credit a: modification of work "Untitled" by Wikimedia Commons, Public Domain; credit b: modification of work "Untitled" by Wikimedia Commons, Public Domain credit c: modification of work "Blood work key to fighter wing health" by U.S. Air Force/ Airman 1st Class Matthew B. Fredericks/Spangdahlem Air Base, Public Domain)

A sterile, color-coded tube used to collect and transport a blood sample is called a **vacutainer tube** (Figure 10.9). This type of tube possesses a partial vacuum due to a rubber stopper, resulting in negative air pressure within the tube that is lower than the surrounding environment. Once the needle is inserted into the vein, the nurse places the vacutainer tube into the vacutainer holder, piercing the stopper and enabling the blood to flow into the tube.

FIGURE 10.9 Different tube colors contain different additives and correspond to specific types of tests. For example, a lavender tube is used for complete blood counts, while a red tube is used for serum tests. (credit: "Medical supplies and equipment " by Simon Davis/UK Department for International Development/Flickr, CC BY 2.0)

A **vacutainer adapter** is a plastic device that holds the vacutainer tube in place and connects to the needle for blood collection. It provides stability and ensures that the tube fills correctly. The main component of the adapter is a plastic body with a grip handle. The adapter's design allows for easy manipulation by healthcare professionals during the venipuncture procedure. The adapter typically features a Luer-lock connection where a needle can be securely attached.

Steps for Central Line Collection

A central venous access device (CVAD) is a long, thin tube inserted into a large vein, typically in the chest or neck. CVADs may have a single lumen (opening), double lumen, or multiple lumens that exit at various places along the central catheter (Figure 10.10). Each lumen has a different use based on its exit point (Table 10.8). A single lumen device consists of one lumen and is typically used in procedures requiring a straightforward fluid pathway. Double lumens incorporate two lumens, allowing for two-way fluid flow or simultaneous administration of different substances. Triple lumen devices, with three lumens, provide even greater versatility, enabling healthcare providers to perform multiple tasks concurrently, such as administering fluids, administering medications, and monitoring central venous pressure. The choice among single, double, or triple lumens depends on the complexity of medical procedures and the diverse functions required.

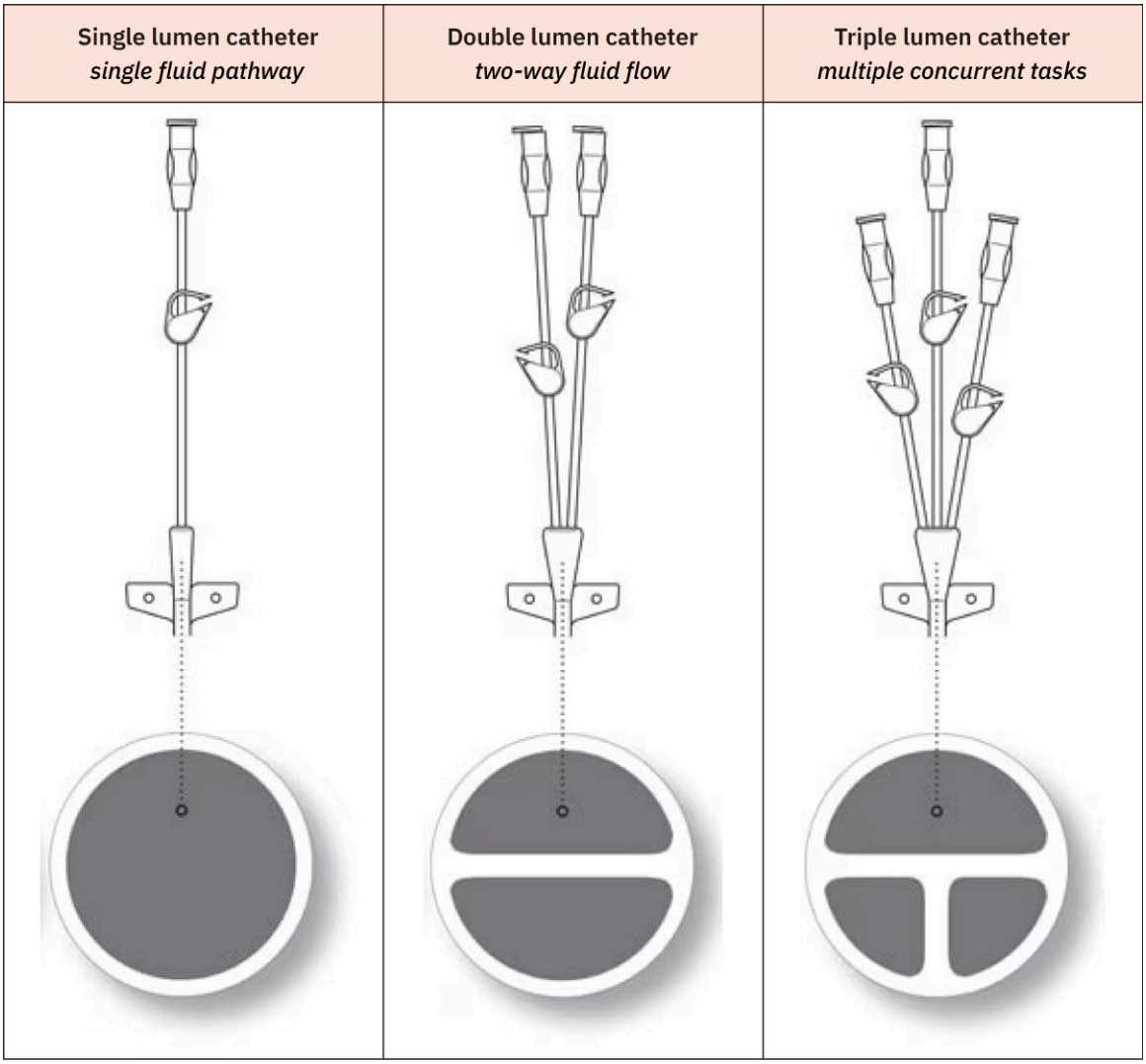


FIGURE 10.10 The designations single, double, and triple lumen pertain to the quantity of individual channels or lumens present within catheters or tubing. A single lumen device contains one pathway; whereas a double lumen contains two separate pathways, and a triple lumen contains three separate pathways. (modification of work: "CVAD Catheters" by National Center for Biotechnology Information/ National Library of Medicine, National Institutes of Health, CC BY 4.0).

Lumens	Proximal Lumen	Middle Lumen	Distal Lumen
Size	18 gauge	18 gauge	16 gauge
Uses	Fluids Total parenteral nutrition/lipids Medications	Medications	Blood draw Blood administration Central venous pressure monitoring

TABLE 10.8 Types of Lumens

Obtaining a blood sample from a CVAD is a responsibility of the registered nurse. Multiple venipunctures frequently occur in acute care settings due to the severity of the medical condition in a patient who requires a CVAD. The main advantage of using a CVAD for frequent blood sampling is decreased pain and anxiety compared to the experience of multiple peripheral venipunctures. However, accessing CVADs also has potential risks associated with infection, occlusion, and improper sample taking, resulting in inaccurate test results. Following evidence-based infection prevention practices, limiting the frequency of blood sampling, and following aseptic no touch technique (ANTT) guidelines help reduce the risk of infection. Note that current guidelines recommend not to use CVADs infusing parental nutrition for blood sampling because manipulation may increase the risk for central line-associated

bloodstream infection (Infusion Nurses Society, 2024). During the blood sampling procedure, if any signs or symptoms occur indicating an air embolism, place the patient on the left side in Trendelenburg or left lateral decubitus position, call the rapid response team, and notify the provider. A summary of the key points of blood sampling from a CVAD is outlined in Table 10.9.

Steps	Rationale
Stop the infusion of fluids and medications into the catheter's lumens.	Stopping the infusion of fluids or medications prevents these substances from interfering with the blood sample. Current guidelines do not specify a standard length of time for stopping the infusion, but the length of time is associated with the internal volume of the specific CVAD (Infusion Nurses Society, 2024).
Choose the appropriate CVAD lumen for obtaining samples based on the largest lumen or the configuration of the lumen exit sites.	Blood draw requires a large lumen. For catheters with a staggered lumen exit at the tip, the sample should be drawn from the lumen exiting at the point farthest away from the heart and above other lumen exits used for infusion (Infusion Nurses Society, 2024). Follow CVAD manufacturer's instructions for these decisions.
Vigorously scrub the needles' connector for at least fifteen seconds with antiseptic scrub and let it dry completely (The Joint Commission, 2023).	Scrubbing prevents microorganism contamination, and drying prevents contamination by substances.
Attach a prefilled 10 mL syringe of preservative-free normal saline to the needleless connector using ANTT. Unclamp the catheter and thoroughly flush the lumen with 10 to 20 mL of preservative-free 0.9 percent normal saline (Infusion Nurses Society, 2024). Aspirate slowly for blood, noting the characteristics of the blood.	A 10 mL syringe generates lower pressure within the catheter and prevents lumen rupture and/or occlusion.

TABLE 10.9 Summary of Key Points Related to Blood Sampling from a Central Venous Access Device (CVAD)

Steps	Rationale
Clear the dead space by using the push-pull method or discarding the aspirated blood according to facility policy. The discard method requires initial aspiration of 2 to 25 mL of blood (per internal volume of the CVAD, saline flushing prior to drawing the discard volume, and specific laboratory tests needed), and then discarding the syringe before performing the blood sampling (Infusion Nurses Society, 2024). The push-pull method utilizes the same syringe used when aspirating to test patency of the catheter. With the syringe still attached, 4 to 6 mL of blood is aspirated and then pushed back into the catheter. This aspiration and reinfusion sequence is repeated for four cycles. The blood and syringe are then discarded (McBride et al., 2018).	Either method clears the CVAD catheter's dead space volume and removes any of the blood that becomes diluted with the flush solution. Performing the push-pull method for four cycles allows for an accurate blood sample and also reduces phlebotomy-associated blood loss, particularly when obtaining multiple blood samples. For the discard method, coagulation studies require the largest discard volume to produce accurate results, but this volume of discarded blood can lead to hospital-acquired anemia.
After obtaining the blood sample, thoroughly flush the CVAD lumen with 10 to 20 mL of preservative-free 0.9 percent normal saline (Infusion Nurses Society, 2024).	Flushing thoroughly prevents occlusion.

TABLE 10.9 Summary of Key Points Related to Blood Sampling from a Central Venous Access Device (CVAD)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Collecting a Central Line Specimen

See the competency checklist for Collecting a Central Line Specimen. You can find the checklists on the Student resources tab of your book page on openstax.org.

Arterial Blood Collection

Drawing an arterial blood sample involves collecting blood from an artery (Figure 10.11), typically the radial artery in the wrist or the femoral artery in the groin.

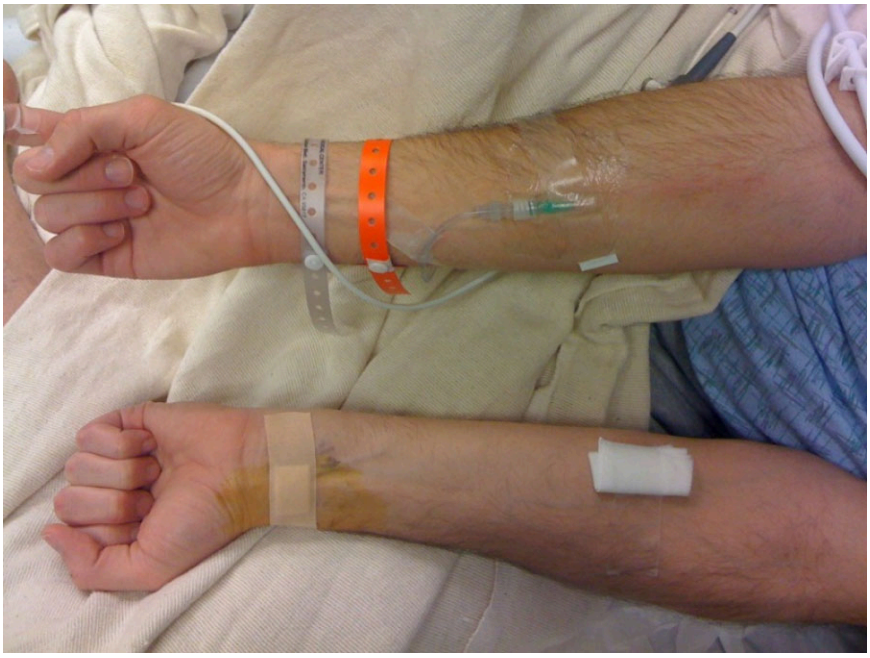


FIGURE 10.11 Arterial blood sampling should only be performed by trained healthcare professionals who are experienced in the procedure and aseptic techniques. (credit: "Intravenous" by "ilvadel"/Flickr, CC BY 2.0)

Performing arterial blood sampling involves several key steps to ensure accuracy and safety. One crucial aspect is assessing collateral blood flow, often done using the modified Allen test to determine the patency of the ulnar artery. This test assesses the adequacy of collateral circulation in the hand before arterial puncture. After confirming sufficient collateral flow, the procedure involves proper hand positioning, sterilization, and selecting an appropriate arterial site, commonly the radial artery. The use of aseptic techniques, ensuring patient comfort, and promptly analyzing the blood sample are essential in the process. Postprocedure, adequate pressure and dressing application to the puncture site help minimize bleeding and promote optimal healing. Careful attention to these steps is vital for accurate arterial blood sampling and ensuring patient safety during the procedure.

Site Selection

Site selection for arterial blood collection is a crucial aspect of the procedure, as it affects the ease of sample collection, patient comfort, and quality of the obtained sample. The radial artery is the most commonly used site for arterial blood collection due to its accessibility and relatively low risk of complications. It is located on the lateral (thumb) side of the wrist, just below the thumb. It can be palpated easily and is typically the first choice for adults. A modified Allen test is performed to check blood flow prior to a radial artery blood draw. The femoral artery is located in the groin area and is typically accessed by the practitioner in emergency situations or when other sites are not viable. The ulnar artery runs parallel to the radial artery on the medial (pinky finger) side of the wrist. It is less commonly used than the radial artery.

LINK TO LEARNING

For the Allen test (https://openstax.org/r/77AllenTest) have the patient clench their fist. Occlude the radial and ulnar arteries with your thumbs Ask the patient to slowly open their hand while you keep pressure on the arteries. The patient's hand should be pale or blanched from lack of arterial blood flow. Release the pressure on the patient's ulnar artery. If the patient's hand becomes flushed, circulation is adequate, and the radial artery may be used. If the patient's hand remains blanched, circulation is inadequate, and a different site should be used.

Capillary Blood Collection

Capillary blood collection, often used for POC testing, glucose monitoring, and other diagnostic tests, involves collecting a small blood sample from capillaries just beneath the skin's surface. Capillary blood samples are typically obtained from the fingertips, earlobes, or heel (in infants).

It is often important to keep the patient's hand warm and in a dependent position to promote vasodilation and obtain a good blood sample. If necessary, warm compresses can be applied for ten minutes prior to the procedure to promote vasodilation. Follow the manufacturer's instructions to prepare the POC machine (Figure 10.12) for measurement, if using. After applying clean gloves, clean the patient's skin with an antiseptic wipe for thirty seconds, allow the site to dry, and then puncture the skin using the lancet. If needed, gently squeeze above the site to obtain a large drop of blood. Do not milk or massage the finger because it may introduce excess tissue fluid and hemolyze the specimen. Wipe away the first drop of blood and use the second drop for the blood sample. Follow facility policy and manufacturer instructions regarding placement of the drop of blood for absorption on the reagent strip. Timeliness is essential in gathering an appropriate specimen before clotting occurs or the POC machine times out.

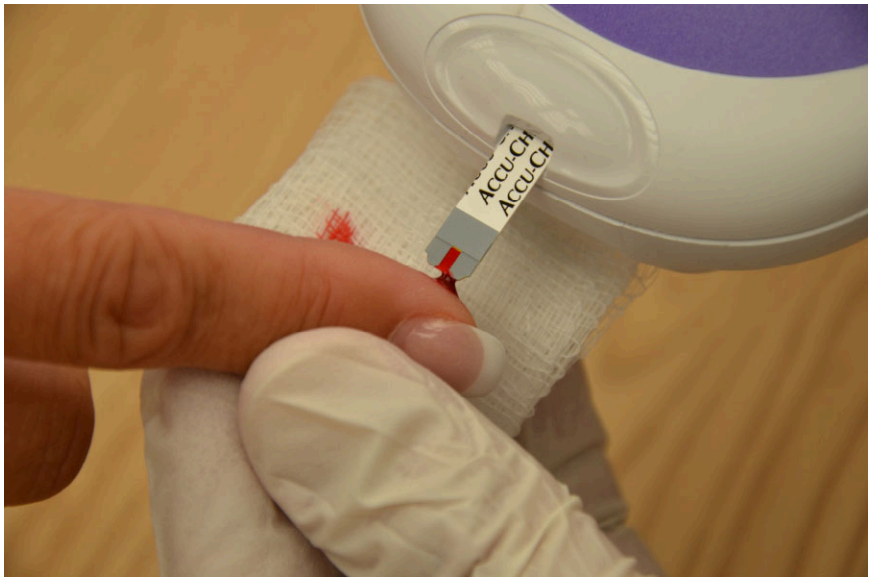


FIGURE 10.12 A nurse uses a lancet to puncture the patient's finger for a capillary blood test, using a POC testing machine. (credit: "DSC 1141.jpg" by British Columbia Institute of Technology, CC BY 4.0)

LINK TO LEARNING

In this video, how to collect a capillary blood sample to check blood sugar (https://openstax.org/r/77CapBloodSamp) is demonstrated.

CLINICAL SAFETY AND PROCEDURES (QSEN)

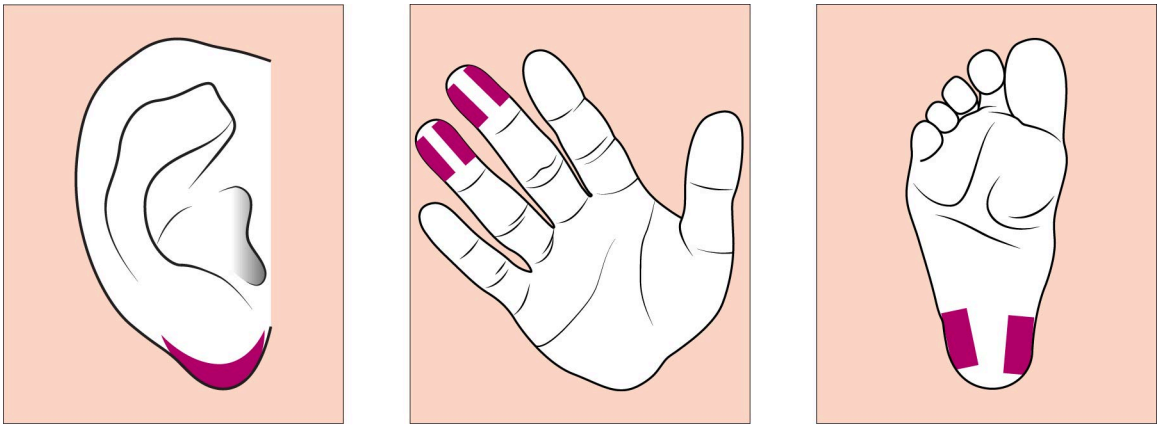
QSEN Competency: Collecting a Capillary Blood Glucose

See the competency checklist for Collecting a Capillary Blood Glucose. You can find the checklists on the Student resources tab of your book page on openstax.org.

Site Selection

Site selection for capillary blood collection is an important consideration to ensure the procedure's success, patient comfort, and accuracy of the results. The choice of collection site depends on various factors, including the patient's age, type of test being performed, and ease of accessing the site. Common sites for capillary blood collection include the fingertip, heel, and earlobe (Figure 10.13). The fingertip is the most commonly used site for capillary blood collection in both adults and older children. This site offers good blood flow, is easy to access, and typically causes less discomfort than some other sites. The heel is often the preferred site for capillary blood collection in infants and newborns, especially for newborn screening or routine blood tests. This site provides a larger blood volume for testing and is less painful for the infant. The earlobe is another site used for capillary blood collection in adults and older children, primarily for POC testing. This site may be chosen when fingertip or heel collection is not

possible or when the patient prefers it.



(a) Earlobe **(b) Sides of fingertips** **(c) Heel**

FIGURE 10.13 Suitable puncture sites for capillary blood testing include the (a) earlobe, (b) sides of the fingertip, and (c) heel. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LIFE-STAGE CONTEXT

Selecting a Capillary Site for Infants

For infants, the primary site for capillary blood sample collection is the heel. When obtaining capillary blood samples in this age group, healthcare providers typically choose the lateral or medial plantar surface of the heel, avoiding the posterior curvature and the center of the heel pad. Due to the sensitivity of infant skin, a gentle and skillful technique is essential to minimize pain and trauma during the procedure.

Documentation of Blood Collection

Proper documentation of blood sample collection is essential for maintaining accurate patient records, ensuring traceability, and providing a clear record of the procedure for healthcare professionals, laboratory technicians, and other involved parties. The blood sample must be labeled with the patient's information, including patient name, date of birth, date and time of collection, and any other requirements according to facility policy.

Once the blood sample has been drawn, document the procedure within the patient's chart. Documentation of blood collection should include the following:

- date, time, type, and site of blood collection
- condition of site after blood collection, if appropriate
- laboratory tests for which samples were obtained
- time when samples were sent to the laboratory
- total volume of blood drawn, if appropriate
- any adverse reactions or interventions performed
- the patient's tolerance of the procedure
- any teaching provided to the patient and family, including understanding of that teaching and any follow-up teaching needed

Patient Education

Patient education is an essential part of the blood collection process and helps reduce patient anxiety, improve cooperation, and ensure that patients understand the procedure, its purpose, and any necessary postcollection care. Be sure to include the following:

- the medical purpose of the blood test
- the steps of the procedure
- how long the procedure will take
- possible complications

- any postprocedure instructions, including signs and symptoms to report to the nurse or provider

For all blood collection routes, clear and open communication is key to ensuring patient understanding and cooperation. Be sure to address any questions or concerns the patient may have.

Interpretation of Results

Interpreting a blood test result involves understanding the **reference range**, which includes the typical values for a specific test, and recognizing whether the result falls within the range. Blood test results can be categorized into three main groups: normal, high (elevated), and low (decreased). In some cases, a **therapeutic range** may be referenced, which includes target values for certain tests when managing specific conditions.

Normal lab results are used as a reference to evaluate whether a person's test values are within an expected range. These ranges are established based on extensive population studies, and they can vary slightly from one laboratory to another as well as with factors such as age, sex, and individual circumstances. Normal results generally suggest that there are no immediate concerns related to that particular parameter.

High or elevated results indicate the value for a specific test is above the upper limit of the reference range. The laboratory results may include an uppercase H or an upward arrow next to the lab value to indicate the result is elevated compared to the normal reference range. High results can indicate various conditions, such as inflammation, infection, organ dysfunction, or other medical issues. It is essential to note that high results may not always be indicative of a severe condition, and further evaluation is needed to determine the underlying cause and potential treatment.

Low or decreased results indicate the value for a specific test is below the lower limit of the reference range. The laboratory results may include a lowercase L or a downward arrow next to the lab value to indicate the result is low compared to the normal reference range. Low results can suggest conditions like anemia, malnutrition, deficiencies, or other health problems. As with high results, low results may require further evaluation to identify the underlying cause and appropriate treatment.

Therapeutic ranges are specific target values used in the management of certain medical conditions. For example, in managing diabetes, the therapeutic range for fasting blood glucose levels might be set at 80 to 130 mg/dL. In this case, the goal is to keep blood glucose within this range to manage the condition effectively. Therapeutic ranges are used to guide treatment decisions and monitor the progress of therapy.

Normal Findings

Blood should be bright red when oxygenated, flow smoothly, and clot within several minutes. Reference ranges for blood tests provide a general guideline as to what the normal findings should be, depending on the test ordered. However, what is considered normal may depend on various factors, including age, sex, and individual health status. Healthcare providers interpret blood test results in the context of the patient's specific health and medical history to determine the appropriate course of action.

Abnormal Findings

Physical characteristics of blood may help to indicate abnormalities in blood. For example, blood that appears dark red may indicate oxygen deprivation (cyanosis) or hemolysis. Increased viscosity may result from dehydration, while decreased viscosity may be due to anemia or other conditions. Blood that clots too easily may indicate a risk of clotting disorders, while blood that clots too slowly may indicate a risk of excessive bleeding.

Chemical and microscopic testing may also be used to indicate abnormal findings. An abnormal reference range in the context of blood test results typically means that the values obtained for a particular test fall outside the normal range established by the laboratory. Results above or below the normal range may suggest an underlying health condition or problem. For example, elevated liver enzymes (aspartate aminotransferase [AST] and alanine transaminase [ALT]) could indicate liver damage. On the other hand, a low red blood cell count may suggest anemia. Abnormal high or low results often warrant further investigation, including additional tests and a medical evaluation to identify the cause and determine appropriate treatment or management. An abnormal result should always be interpreted in the context of the patient's overall health, medical history, and any specific symptoms or concerns. Not all abnormal results indicate a serious health issue; some may be temporary and reversible. In some cases, an isolated abnormal result can be due to laboratory error or other transient factors. Repeat testing may be

recommended to confirm the abnormality. If an abnormal result is confirmed and is indicative of a medical condition, the healthcare provider will develop a treatment or management plan, which may involve medication, lifestyle changes, or further diagnostic tests.

CLINICAL JUDGMENT MEASUREMENT MODEL

Prioritize Hypotheses: Interpreting Blood Test Results

Clinical judgment in recognizing an abnormal lab result involves a systematic approach that considers not only the numerical value of the result but also the patient's clinical history, symptoms, and other relevant information.

A 45-year-old patient, Mr. Suarez, presents to the emergency department with severe abdominal pain and vomiting. He has a history of alcohol abuse. A comprehensive blood panel is ordered, including liver function tests (LFTs). The patient's LFTs show the following:

- aspartate aminotransferase (AST): 780 U/L (normal range: 10 to 40 U/L)
- alanine aminotransferase (ALT): 890 U/L (normal range: 7 to 56 U/L)
- total bilirubin: 2.5 mg/dL (normal range: 0.2 to 1.2 mg/dL)
- alkaline phosphatase (ALP): 150 U/L (normal range: 44 to 147 U/L)

The nurse notes the elevated AST and ALT are significantly above the normal range, indicating possible liver damage. The total bilirubin and alkaline phosphatase levels are also elevated, suggesting possible obstruction of the bile duct. Assessing the clinical context, the nurse evaluates Mr. Suarez's clinical history, symptoms, and risk factors. The patient's severe abdominal pain, vomiting, and history of alcohol abuse are considered. Provided the elevated liver enzyme levels and clinical context, the nurse considers potential causes for the abnormal laboratory findings, such as alcoholic hepatitis, acute pancreatitis, or biliary obstruction.

Factors Affecting Results

Blood test results can be influenced by a variety of factors, including individual, environmental, and technical factors. Common interfering factors are listed in Table 10.10.

Factor	Effect on Blood Testing
Not allowing antiseptic to fully dry	Hemolysis of the specimen
Improper tube volume collected (underfilling or overfilling tubes)	Improper additive-to-blood ratio, causing incorrect results
Improper CVAD collection procedure	Contamination of specimen
Collecting a sample in the same limb as an IV infusion	Contamination or dilution of specimen
Using a syringe to collect blood	Hemolysis, overfilling or underfilling of collection tube
Excessive probing during venipuncture	Hemolysis, contamination with interstitial fluid, patient nerve injury
Improper handling/storage	Incorrect results

TABLE 10.10 Common Interfering Factors Affecting Blood Testing

Factor	Effect on Blood Testing
Incorrect specimen labeling	Incorrect results
Leaving the tourniquet on the arm for too long	Hemolysis (lysing of the red blood cells can cause increased potassium levels)

TABLE 10.10 Common Interfering Factors Affecting Blood Testing

Patient factors that can affect the results of blood testing include medications, exercise, fasting, malnutrition, dehydration, certain diets, and compliance with the procedure. Time of day can also affect blood results.

Summary

10.1 Urine Specimen

A urinalysis is a valuable tool that allows for diagnosing and monitoring certain medical conditions. Urine testing examines the physical, chemical, and microscopic composition of a sample of urine including the color, turbidity, presence or absence of particles, odor, pH, specific gravity, protein, ketones, glucose, bilirubin, nitrites, and leukocytes. Common types of urine sample collections include clean-catch collection, twenty-four-hour urine collection, FMV collection, timed collection, catheter collection, suprapubic aspiration, pediatric bag collection, and random urine collection. The procedure for urine collection depends on the type of test ordered; however, regardless of the type of sampling, a sterile collection is essential for ensuring the sample is not contaminated. Following the collection procedure, it is important to label the specimen with the correct patient identifiers and transport the sample to the laboratory within a reasonable time frame. Other key aspects of collecting a urine sample include educating the patient on how to perform the procedure (particularly regarding measures for keeping the sample free of contamination) and accurately documenting the procedure. To correctly interpret the results, the nurse must be aware of normal findings, abnormal findings, and factors that affect the results. Urinalysis results may be affected by a variety of factors, including diet, medications, medical conditions, and contamination.

10.2 Stool Collection

Stool collections are a valuable tool for diagnosing and monitoring certain medical conditions. Stool testing examines the physical, chemical, and microscopic composition of a sample. It assesses factors such as color, consistency, shape, odor, mucous, undigested good particles, parasites or worms, blood, fats, carbohydrates, enzymes, and pH. Common types of stool sample collections include random collection, three-day collection, fecal occult blood, stool culture, O&P testing, stool fat testing, and *C. difficile* testing. Stool samples may be collected in a plastic container or on plastic wrap and then transferred into the collection cup with a wooden stick. Caution must be given to ensure the sample is not contaminated with urine, toilet paper, or other potential sources of bacteria. Occult blood testing collects samples from different parts of the stool and smears them on a sampling card to determine the presence of blood in the stool. Following either type of collection procedure, it is important to label the specimen with the correct patient identifiers and transport the sample to the laboratory within a reasonable time frame. Other key aspects of collecting a stool sample include educating the patient on how to perform the procedure (particularly regarding measures for keeping the same free of contamination) and accurately documenting the procedure. To correctly interpret the results, the nurse must be aware of normal findings, abnormal findings, and factors that affect the results. Stool collection results may be affected by a variety of factors, such as diet, medications, medical conditions, timing, and contamination.

10.3 Sputum Collection

Sputum, nasal, and throat specimens are key in diagnosing and managing various respiratory conditions, including bronchitis, pneumonia, COVID-19, influenza, tuberculosis, COPD, and lung cancer. Methods of sputum collection include spontaneous and induced collection, nasotracheal suction collection, bronchoscopy collection, and collection via a sputum trap. Methods of nasal and throat collection include nasopharyngeal, oropharyngeal, and nasal.

Key aspects of collecting a sputum, nasal, or oropharyngeal specimen include educating the patient on how the procedure is performed, performing the procedure correctly to obtain a quality specimen, and accurately documenting the procedure. To correctly interpret the results, the nurse must be aware of normal and abnormal findings as well as factors that affect the results. Factors such as diet, medical conditions, medications, underlying conditions, and proper collection techniques may affect the sputum results. Factors such as proper collection technique, time of testing in relation to onset of symptoms, swab selected for collection, and administration of antibiotics and antivirals may affect nasal and throat specimen results.

10.4 Blood Sampling

Understanding blood and its properties is crucial for healthcare professionals in diagnosing and managing various medical conditions. Blood is a complex bodily fluid with distinct chemical, physical, and microscopic characteristics. Blood is composed of plasma, red blood cells, white blood cells, and platelets. Chemical, physical, and microscopic

characteristics of blood include pH, blood gas levels, color, viscosity, volume, temperature, and specific gravity as well as presence of red blood cells, white blood cells, platelets, and microorganisms.

Collecting a blood specimen is a fundamental aspect of patient care and medical diagnostics. Blood samples may be taken from veins, arteries, or capillaries. Whereas venous and arterial samples are collected by inserting a needle into the vein or artery, capillary samples are collected by puncturing the skin of the finger, heel, or earlobe with a lancet. Venous samples may also be collected using strict aseptic technique from an existing central line by trained professionals. Proper technique and equipment are essential to ensure the accuracy of the sample and the patient's comfort. The interpretation of blood sample results depends on the tests performed and their reference ranges. To correctly interpret the results, the nurse must be aware of normal and abnormal findings as well as factors that affect the results. Factors such as timing and types of food intake, medications, exercise, and proper collection techniques may affect blood results.

Key Terms

arterial blood sampling blood is obtained via puncture into an artery
bronchoscopy collection invasive procedure where a thin, flexible tube with a camera is inserted into the airways, and sputum samples are collected from specific areas within the respiratory system
butterfly needle winged infusion set with a vacutainer attached
capillary blood collection obtaining blood from capillaries
catheterized urine sample a catheter is inserted into the bladder to obtain a urine sample directly from the bladder
clean-catch urine sample patient is instructed to start urinating into the toilet, stop briefly, and then continue urinating into the collection container; most common method of urine collection
complete urinalysis examines the physical, chemical, and microscopic composition of a sample of urine
dipstick special test strip containing chemically infused pads
fecal occult blood card card containing a testing area that changes color when it comes into contact with blood
fecal occult blood test (FOBT) test used to detect small amounts of blood in the stool
feces (also, stool or bowel movement) solid waste product that is expelled from the body through the rectum and anus during the process of defecation
first morning void (FMV) sample collecting the first urine voided in the morning
hematochezia bloody stool
hematuria blood in the urine
induced sputum collection a hypertonic saline or other aerosolized agent is used to induce sputum production
lancet device used to puncture the skin to collect a capillary blood sample
melena dark, tarry stools, often associated with upper gastrointestinal bleeding
multiple-draw needle needle that connects to a separate vacutainer
nasal swab a swab is used to collect a sample from the inside of the nasal passage
nasopharyngeal swab a swab is used to collect a sample from the nasopharynx, which is the upper part of the throat that connects to the back of the nasal cavity
nasotracheal suction collection a nasotracheal suction catheter is used to collect sputum directly from the lower respiratory tract
occult blood blood that is hidden from plain sight
oropharyngeal swab a swab is used to collect a sample from the oropharynx, which is the part of the throat at the back of the mouth
pediatric collection device a urine collection bag for infants and young children
plasma the dominant component of blood that contains water, proteins, electrolytes, lipids, and glucose
random stool sample a single stool sample collected at any time without specific timing or preparation
random urine sample a urine sample collected at any time without specific timing or preparation
reference range includes typical values for a specific laboratory test
spontaneous sputum collection patient coughs up sputum into a sterile container
sputum mucus and other secretions that are coughed up from the mouth
sputum trap a specialized collection device that attaches to the patient's breathing equipment (such as ventilators) to collect sputum samples
steatorrhea fat in the stool

stool culture used to identify and isolate specific bacteria or pathogens causing gastrointestinal infections
stool fat test used to measure the amount of fat in the stool
stool for *Clostridium difficile* (*C. diff*) toxin detects the presence of *C. difficile* toxins in the stool
stool for ova and parasites (O&P) testing used to identify the presence of parasites or their eggs in the stool
stool specimen (also, fecal specimen or fecal sample) a sample of feces (solid waste) collected from a person for laboratory analysis
suprapubic aspiration invasive method involving using a needle and syringe to aspirate urine directly from the bladder through the abdominal wall
therapeutic range includes target values for certain tests when managing specific conditions
three-day stool collection stool samples are collected over a period of three consecutive days
timed urine collection collect urine at specific times throughout the day
tourniquet tightly tied band applied around a limb to temporarily constrict or restrict blood flow
turbidity cloudiness or haziness
twenty-four-hour urine collection collection of all urine produced over a twenty-four-hour period
urinary casts small particles shaped like a tube that may contain different types of cells or substances
vacutainer adapter a plastic device that holds the vacutainer tube in place and connects to the needle for blood collection
vacutainer needle a needle with a built-in vacutainer adapter
vacutainer tube a sterile, color-coded tube used to collect and transport a blood sample
venipuncture the process of introducing a needle into a patient's vein to collect a blood sample or insert an IV catheter

Assessments

Review Questions

1. The nurse is reviewing the procedure for collecting a urine sample from a Foley with a nursing student. What statement by the nursing student demonstrates accurate understanding of the procedure?
    a. "Since the patient has a Foley, I can just collect the urine sample from the Foley bag."
    b. "Once I connect the syringe to the sampling port, I can pull the urine out of the Foley tubing."
    c. "I will clamp the Foley tubing above the sampling port, connect the syringe, and then withdraw the urine."
    d. "Once I get all of the urine out of the Foley tubing, I will clamp the tubing and then aspirate the urine from the bladder."

2. The nurse is educating the patient on how to collect a clean-catch urine sample. What instruction should the nurse provide to the patient?
    a. Urinate into the collection container first, and then you can finish urinating in the toilet.
    b. Use the urine measuring container in the restroom to collect the sample, and then pour it into the collection container.
    c. Start urinating, stop briefly, and then continue urinating into the collection container.
    d. Use an antiseptic wipe to clean the genital area from back to front before collecting the sample.

3. How much urine is typically needed to perform urine testing?
    a. 15 to 30 mL
    b. 30 to 60 mL
    c. 60 to 90 mL
    d. 100 to 120 mL

4. The nurse is reviewing the urine results for a patient. What finding would be considered abnormal?
    a. pH = 7.7
    b. specific gravity = 1.025
    c. protein = 115 mg/day
    d. squamous cells = 29 cells/high-powered field

5. The nurse is collecting a patient's urine for a twenty-four-hour urine collection. What should the nurse do to ensure the validity and accuracy of the results?
   a. keep the urine at room temperature
   b. collect the urine until the sample container is full
   c. include the first morning void at the start of the twenty-four hours
   d. collect the urine in a urinal, and then pour it into the twenty-four-hour collection container

6. What is the primary purpose of collecting a stool specimen for analysis?
   a. to assess lung function
   b. to evaluate cardiovascular health
   c. to understand gastrointestinal health
   d. to determine kidney function

7. What is the primary diagnostic purpose of a FOBT?
   a. to detect infections in the gastrointestinal tract
   b. to assess carbohydrate malabsorption
   c. to detect small amounts of blood in the stool
   d. to measure fat content in the stool

8. Why is it important to consider the patient's clinical history and influencing factors when interpreting stool test results?
   a. It helps determine the patient's age.
   b. It can reveal the patient's blood type.
   c. It provides context for accurate interpretation.
   d. It helps identify the patient's vaccination history.

9. In the documentation of stool collection, why is it important to include the patient's name, date of birth, collection date, and time of collection?
   a. to identify the patient's blood type
   b. to ensure proper sample storage
   c. to track the sample and interpret results accurately
   d. to determine the patient's age

10. A patient with a history of IBD presents with a change in bowel habits, bloody diarrhea, and abdominal pain. The stool sample reveals the visual presence of blood. What should be the nurse's initial action?
   a. instruct the patient to consume a high-fiber diet
   b. notify the healthcare provider immediately
   c. administer an antiparasitic medication
   d. suggest over-the-counter antacids

11. While collecting a sputum sample, the nurse notes the color of the sputum is yellow. What does this finding most likely indicate is going on with the patient?
   a. bacterial infection
   b. new blood
   c. old blood
   d. virus

12. The nurse is precepting a nursing student who is preparing to perform a sputum collection. What statement by the nursing student would warrant further education?
   a. "An induced sputum collection technique can be used if the patient has difficulty producing sputum."
   b. "A nasotracheal suction collection technique is ideal when samples are needed from the upper respiratory tract."
   c. "A sputum trap can be attached to the patient's ventilator to collect a sputum sample."

d. "A spontaneous sputum collection technique allows the patient to cough up sputum and spit it into a sterile container."

13. The nurse is reviewing the results of a sputum sample that was collected earlier during the shift. What is *not* a cellular component that could be discovered using microscopic examination of the sputum?
a. white blood cells
b. red blood cells
c. squamous epithelial cells
d. parasites

14. A patient brings a sputum sample collected at home into the clinic for testing. What statement made by the patient would warrant further exploration?
a. "I tried to cough something up last night. It didn't work, so I followed your tip of trying to collect the sample in the morning."
b. "I made sure to wash my hands before I opened the cup. I was careful the lid did not touch any surface in my house."
c. "I noticed the sputum looked really thick. It is really sticky and stuck to my finger."
d. "I had some saliva in my mouth when I coughed up the sputum, but I spit it out before spitting the sputum in the cup."

15. When collecting a spontaneous sputum sample, what essential step should be taken to minimize contamination and ensure the accuracy of test results?
a. Instruct the patient to rinse their mouth with water just before collection.
b. The nurse dons gloves, mask, and eyewear prior to collecting the sample.
c. Collect the sputum in an open container to avoid trapping any oral bacteria.
d. Label the collection container with the patient's identification information.

16. The nurse is preparing to collect a blood sample. What is the primary reason for using a tourniquet during venipuncture for blood collection?
a. to increase patient comfort
b. to make the vein more visible and accessible
c. to reduce the risk of hematoma formation
d. to prevent the formation of blood clots in the tube

17. The nurse is assessing a patient's veins to select a site for a blood collection. What factor is most crucial when choosing an appropriate site for venipuncture during blood collection?
a. the patient's dominant hand
b. the site closest to the heart
c. the condition and accessibility of the vein
d. the convenience for the healthcare provider

18. The nurse is reviewing the results of a blood sample with a newly graduated nurse. What statement made by the newly graduated nurse would warrant further education?
a. "Reference ranges provide a general guideline as to what the normal findings should be."
b. "Normal findings can depend on age, sex, and individual health factors."
c. "Elevated results are concerning and indicate something is wrong."
d. "Therapeutic ranges determine if certain conditions are well managed."

19. The nurse is collecting a venous blood sample. Upon puncturing the vein, what is the nurse's next action?
a. release the tourniquet
b. attach the vacutainer tube
c. attach the vacutainer
d. retract the needle

Check Your Understanding Questions

1. List three factors that may affect the results of urine testing.
2. What is the difference between stool culture and ova and parasite testing?
3. What is sputum?
4. Why is it important to follow the correct procedure for sputum collection?
5. What is the difference between nasopharyngeal, oropharyngeal, and nasal collection techniques?
6. What is a reference range?

Reflection Questions

1. Why would it *not* be appropriate to collect a urine sample directly from a Foley bag?
2. Why should the urine sample be labeled after it is collected instead of before it is collected?
3. Why should iron supplements be avoided before stool sampling?
4. Why is it important for a stool sample to be fresh?
5. Imagine you have a patient who has an order for a sputum sample; however, they have been unable to cough anything up. What strategies could you implement to encourage expectoration?

What Should the Nurse Do?

Mrs. Jones, a 67-year-old female, has been experiencing frequent urination and discomfort during urination. Her primary care physician has requested a urine sample to investigate possible urinary tract issues. Mrs. Jones arrives at the clinic for urine sample collection. She is provided with a sterile urine collection container and instructions. However, during her attempt to collect the urine sample, she only manages to provide a very low volume of urine. To make matters worse, as she tries to pour the limited sample into the container, she accidentally spills some into the toilet.

1. What should the nurse do?
2. What measures could be taken to prevent similar situations in the future?
3. What impact might the low urine volume and loss of the initial sample have on the accuracy of Mrs. Jones's diagnosis or treatment plan?
4. What should be documented in Mrs. Jones's medical record regarding the low-volume urine sample and the spilled sample?

Jane is a 35-year-old female who visits her primary care physician with complaints of persistent gastrointestinal discomfort, abdominal pain, and irregular bowel movements. She has been experiencing these symptoms for several weeks. Her medical history is unremarkable, and she has not had any major surgeries or gastrointestinal issues in the past. Jane is generally healthy and follows a balanced diet.

5. Given Jane's symptoms, what is the importance of recommending a stool sample analysis?
6. What specific information could be obtained through this analysis?
7. What instructions should be given to Jane to ensure the procedure is conducted correctly and hygienically?
8. How can the healthcare provider educate Jane about the importance of proper stool sample collection, handling, and the role of stool testing in maintaining gastrointestinal health?

Sarah is a 7-year-old child who has been experiencing fatigue, pallor, and shortness of breath recently. Her parents are concerned and bring her to the pediatrician's office for an evaluation. The healthcare provider suspects that Sarah may have iron-deficiency anemia and decides to perform capillary blood sampling to confirm the diagnosis and assess her hemoglobin and hematocrit levels.

9. What is capillary blood sampling?
10. How does it differ from venous blood sampling?
11. Explain the advantages and disadvantages of using capillary blood sampling in pediatric patients like Sarah.
12. What is an appropriate site for capillary blood sampling in a pediatric patient?

Competency-Based Assessments

1. Demonstrate the procedure for collecting a urine sample from an indwelling Foley.
2. Create a handout to educate patients on how to perform a clean-catch urine sample collection.
3. Create an infographic that can be used to educate patients about how to collect a stool sample in the home setting.
4. Demonstrate the procedure for collecting a sputum sample via the spontaneous sputum collection method.
5. Create a flier to educate patients on how to collect a sputum sample at home.
6. Demonstrate the procedure for collecting a nasopharyngeal throat specimen.
7. Outline the procedures for obtaining a capillary blood sample.

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CHAPTER 11
Principles of Medication Administration

FIGURE 11.1 Medication administration is a common function of the nurse. (credit: "3rd Medical Battalion nurses and Corpsmen conduct ICU training 200424-M-RB959-1103" by Staff Sgt. Jordan E. Gilbert/Navy Medicine, Public Domain)

CHAPTER OUTLINE

11.1 Rights of Medication Administration
11.2 Dosing
11.3 Documentation of Medication Administration

INTRODUCTION In the United States, medication errors affect more than 7 million patients and result in approximately 7,000 to 9,000 deaths each year (Tariq et al., 2023). These statistics include only those cases reported and do not account for the hundreds of thousands of adverse reactions, complications, or medication errors that are not reported. Although death is the most severe outcome, medication errors may also result in other negative consequences, such as increased medical costs (exceeding $40 billion each year in the United States), psychological stress and physical pain, suffering, decreased patient satisfaction, and decreased trust in providers and the healthcare system (Tariq et al., 2023).

Medication errors generally occur at the point of ordering, transcribing, dispensing, administering, monitoring, or documenting. It is important to note that medication errors are preventable and may be avoided with appropriate safety precautions (Tariq et al., 2023). Nurses play a critical role in ensuring these safety precautions are implemented. Nurses also design and evaluate safety initiatives, whether at the bedside or in other capacities, such as leadership, and safety/quality programs. To effectively reduce the risk of medication errors, it is important to practice nursing standards of care through application of principles for safe medication administration, understanding specific safety considerations, and knowledge of common sources of errors. This chapter provides the knowledge necessary to engage in the process of ensuring safe medication administration.

11.1 Rights of Medication Administration

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify components of a medication order
- List safety measures important in the administration of medication
- Verbalize the rights of medication administration

Fifty percent of medication errors occur during the medication ordering process (Tariq et al., 2023). These errors are commonly attributed to an incorrect or incomplete medication order. Medication errors may also occur during the process of transcribing, dispensing, administering, and monitoring. Because 30 to 70 percent of medication-ordering errors are identified by nurses and pharmacists, nurses must be equipped with the knowledge to be able to identify these medication-ordering errors before they reach the patient (Tariq et al., 2023). Nurses hold great responsibility in preventing medical errors and need to be aware of how to apply safety measures throughout the medication administration process.

Types of Medication Orders

Medication orders are prescriptions ordered within clinical practice. When administering medications, it is important for the nurse to be aware of the various types of medication orders that may be written. Common types of medication orders include routine orders, one-time orders, standing orders, STAT orders (to be completed now), and PRN (as needed) orders. Each order type has indications for nursing practice. Identifying the order type helps the nurse to prepare for medication administration by knowing which medications to administer, when to administer them, as well as specific indications for administration.

A medication order that is continuously followed until canceled is known as a **routine order**. For example, "Aspirin 81 mg PO Q day" is a routine order. For the order to be canceled, the provider would need to discontinue the order. An order for a medication to be administered just one time is known as a **one-time order**. An example of a one-time order is "Cefazolin (Ancef) 2 g IV × 1 dose before surgery." A standardized order that may be implemented under certain circumstances is known as a **standing order**. Standing orders are written to address protocols in which the nurse can intervene in a timely manner without having to wait on the provider to write orders, or there are general guidelines for treating a certain condition. For example, surgical procedures often utilize standing orders that allow the nurse to administer medications for pain, nausea or vomiting, constipation, and venous thrombosis prophylaxis. A **STAT** order is a one-time order that is administered as urgently as possible. An example of a STAT order may be to administer "Lorazepam (Ativan) 1 mg IV STAT" when the patient is having a seizure. Medication orders to be administered as needed are known as **PRN** orders. PRN medications are commonly ordered for symptoms such as pain, nausea or vomiting, itching, sleep, cough, or fever greater than 101°F. An example of a PRN order is "Diphenhydramine (Benadryl) 25 mg PO Q4 hours PRN itching." It is important to note that a PRN medication may only be administered for the ordered indication. For instance, an order that reads "Acetaminophen 500 mg PO PRN headache" cannot be administered for mild arthritic pain.

Components of a Medication Order

According to the Centers for Medicare and Medicaid Services (2014), all medication orders must contain the following:

- patient's full name and date of birth
- name of the drug
- drug dose, route, and frequency
- date and time medication order was written
- name and signature of the prescriber

The following additional requirements must also be included when applicable:

- weight of the patient if dose calculation is based on weight (kilograms for children and adults, grams for newborns)
- dose calculation requirements
- exact strength or concentration of medication

- specific quantity or duration to be administered
- specific instructions for use
- reason for use if medication is ordered PRN

An example of a complete medication order is shown in (Figure 11.2).

Patient: Rose Sanchez **Age:** 40	**Date of Birth:** 04/18/1983 **Room:** 366M	**Medical Record Number:** 008222014

Date/Time	Medication	Prescriber
02/10/2023 Time: 07:54 AM	Enoxaparin (Lovenox) 30 mg SQ Q12 hours	Grace Chen, NP
	Acetaminophen (Tylenol) 500 mg PO Q4 hours PRN mild pain	Grace Chen, NP
	Oxycodone/acetaminophen (Percocet) 5 mg/325 mg PO Q6 hours PRN moderate pain	Grace Chen, NP
02/10/2023 Time: 10:21 AM	Promethazine (Phenergan) 12.5 mg IV Q6 hours PRN nausea and vomiting	Grace Chen, NP

FIGURE 11.2 A complete medication order includes the patient's information as well as the date, medication and dosage, and prescriber's name. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Drug Nomenclature

Drugs are provided with three categories of names: (1) a chemical name, (2) a generic name, and (3) a brand name (Table 11.1). The chemical name is assigned upon discovery of the drug. It is a scientific name that describes the chemical structure of the drug and is typically complex. Once approved by the U.S. Food and Drug Administration (FDA), the drug is assigned a generic (nonproprietary) name and a brand (proprietary) name (Merck & Co., 2023).

Chemical Name	Generic Name	Brand Name
N-acetyl-para-aminophenol	Acetaminophen	Tylenol
Dihydroxy monocarboxylic acid	Atorvastatin	Lipitor
3-(α-Acetonylbenzyl)-4-hydroxycoumarin sodium salt	Warfarin	Coumadin

TABLE 11.1 Examples of Drug Chemical Names, Generic Names, and Brand Names

The generic name is assigned by the United States Adopted Names (USAN) Council and utilizes the drug's "family name" as the suffix (e.g., *-olol*, *-pril*, *-statin*, *-vir*). Once approved, the USAN submits the generic name to the World Health Organization (WHO). The WHO then adds the drug name to the recommended International Nonproprietary Names list as a means of promoting global standardization of drug names. The brand name is assigned by the drug company and is often short, catchy, easy to remember, and suggestive of the intended use. Given the goal of standardizing drug names, it is recommended that medication orders be written using the generic drug name. However, it is important for the nurse to be aware of both the generic and brand names, as patients are more likely to resonate with the brand name.

Dosage of the Drug

The dosage of the drug refers to how much of a drug a patient should receive. Drug dosages may be written using three systems of measurements: metric system, household, or apothecary. According to the Institute for Safe Medication Practices (ISMP, 2021), household and apothecary measurements should only be used to provide directions for mixing dry ingredients to prepare a topical product. In all other circumstances, the metric system should be used. Common units of measurement for drug doses include the following:

- milliliter (mL)
- liter (L)

- units
- microgram (mcg)
- milligram (mg)
- kilogram (kg)
- gram (g)

Special care should be given to orders that contain a zero. Drug dosages should not be written with trailing zeros. For example, 1 milligram should be written as 1 mg instead of 1.0 mg to reduce the risk of the dosage being mistaken for 10 mg. However, if the dose is less than one unit, a zero must be included before the decimal point, often called a leading zero. For example, half a milligram should be written as 0.5 mg instead of .5 mg to reduce the risk of the dosage being mistaken for 5 mg.

REAL RN STORIES

Ensuring Correct Dosage

Nurse: Sarah, BSN
Clinical setting: Orthopedic unit
Time in practice: 2 months
Facility Location: The inner city of a small metropolitan area in New Jersey

I was a newly graduated nurse who had been working on the orthopedic floor for several weeks. Being new to the department, I had not yet become familiar with the typical medication orders written by the orthopedic surgeons. After morning rounds, Dr. Black notified me that Mrs. James was experiencing severe pain, and a new order was placed for IV Dilaudid. Dr. Black requested that Mrs. James receive a dose right away, without delay.

I opened the chart and read the order as hydromorphone (Dilaudid) 5 mg IV Q2 hours PRN severe pain. A copy of the order was sent to the pharmacy for processing. Remembering the medication could be overridden in the automated medication dispensing machine, I decided to go ahead and administer the medication before the pharmacy processed the order, because Mrs. James was in severe pain and shouldn't have to wait for pain medicine.

After retrieving the medication from the automated medication dispensing machine, I noticed that Dilaudid was stored in 1 mg vials. Given the order was for 5 mg, I requested to remove five vials. An alert popped up notifying me that an unsafe amount of the drug had been requested and questioned me if the requested amount was correct. I was unsure why the message was being generated and didn't know what to do. Upon discussing the situation with my preceptor, she pointed out in the chart that there was actually a decimal point in front of the 5 that merged with the tail of the number. The order actually read: "hydromorphone (Dilaudid) .5 mg IV Q2 hours PRN severe pain." Had the order been written as "hydromorphone (Dilaudid) 0.5 mg IV Q2 hours PRN severe pain," I wouldn't have misread the order. Thankfully, we recognized the intended dose prior to administering the medication, and the patient was not administered 10 times the intended dose.

Route of Drug

The route of the drug is the method by which the drug should be administered. Common routes of drug administration include oral (by mouth), sublingual (beneath the tongue), buccal (toward the cheek), subcutaneous (beneath the skin), intramuscular (within a muscle), intravenous (within a vein), nasal (by nose), inhalation (by respiratory tract), vaginal (by vagina), rectal (by rectum), transdermal (through the dermal layer of skin), topical (on the skin), otic (by ear), ophthalmic (by eye), and enteral (through nose and into stomach via a tube). Commonly used abbreviations for medication routes can be found in (Table 11.2). A drug may only be administered via the ordered route. In the event the medication cannot be administered via the route ordered, the nurse must notify the provider.

Abbreviation	Definition
AD	Right ear
AS	Left ear
AU	Each ear; both ears
BU or BUC	Buccal
EPI	Epidural
IA	Intra-arterial
IC	Intracardiac
ID	Intradermal
IM	Intramuscular
INH	Respiratory (inhalation)
IT	Intrathecal
IV	Intravenous
IVP	Intravenous push
IVPB	Intravenous piggyback
NAS	Nasal
NG	Nasogastric
NGT	Nasogastric tube
OD	Right eye
OS	Left eye
OU	Each eye; both eyes
PO	Per mouth
PR	Per rectum
SC or SQ	Subcutaneous
SL	Sublingual

TABLE 11.2 Abbreviations for Routes of Administration

Abbreviation	Definition
TD	Transdermal
TOP	Topical
PV	Per vagina

TABLE 11.2 Abbreviations for Routes of Administration

Frequency of Drug

The frequency of the drug refers to how often or how many times per day the medication should be administered. Examples of drug frequency include Q30 minutes (every 30 minutes), Q4 hours (every 4 hours), Q12 hours (every 12 hours), Q day (daily), BID (twice daily), TID (three times daily), QID (four times daily), and QHS (at bedtime). If the frequency is denoted in terms of number of times per day, the frequency can be determined by dividing 24 hours per day by the number of times the drug should be administered. For example, a medication ordered twice daily should be administered every 12 hours (24 hours in a day/2 administrations = every 12 hours), and a medication ordered three times daily should be administered every 8 hours (24 hours in a day/3 administrations = every 8 hours).

LINK TO LEARNING

The abbreviations posted on The Joint Commission's "Do Not Use" list (https://openstax.org/r/77donotuselist) are prohibited and must not be used in medication orders or documentation of medications.

Date, Time, and Signature of Provider

For the medication order to be complete, it must include the date and time the order was written, along with the prescriber's signature (electronic or handwritten). Best practice is for the provider to enter the order; however, there may be times when the provider is not able to do so, and a verbal order is required (Patient Safety Authority, 2006). When taking a verbal order, the nurse must restate the order back to the provider to ensure the message was received correctly, immediately document the verbal order in the patient's chart, and the provider must review and sign the order according to the agency's policy. Nurses should be aware that both state and organizational policies will dictate required verbal order components. Be sure to follow the organization's policies.

Safety Measures for Medication Administration

Given the risk of medication errors, there are many safety measures that should be implemented when administering medications. These safety measures fall into four categories: ensuring correct identification of the patient, checking the medication order for errors, maintaining a safe environment, and monitoring for adverse reactions. Medication administration safety is a priority; therefore, these safety checks may be confirmed by the nurse, provider, and pharmacist. By using an interdisciplinary team approach, safety measures may be assessed at multiple checkpoints and by several professionals, thereby reducing the opportunity for medication errors to occur.

In addition, there are several organizations that work to support safety measures for medication administration. The ISMP is a nonprofit organization dedicated to preventing medication errors. Known for being the gold standard in medication safety, the ISMP is responsible for developing safe medication standards, drug packaging and labeling recommendations, tools, and resources for the healthcare community, as well as leading public policy efforts. For example, the ISMP developed a list of look-alike and sound-alike drugs, recommended use of tall man lettering for labeling of products with look-alike and sound-alike names, published recommended abbreviations, developed a list of high-alert medications, and established a medication error reporting program, just to name a few accomplishments (ISMP, n.d.).

LINK TO LEARNING

The Institute for Safe Medication Practices (ISMP) develops safe medication standards. Review the ISMP's current list of drug names with tall man lettering (https://openstax.org/r/77tallman2), a strategy used to reduce medication errors related to look-alike and sound-alike medications.

Another organization that works to support safety measures for medication administration is The Joint Commission. The Joint Commission evaluates and accredits healthcare organizations across the United States. The organization develops practice standards that are essential to providing safe, high-quality care. In addition, they establish national patient safety goals, issue sentinel event alerts, and provide evidence-based practice recommendations aimed at addressing identified safety concerns. Some of these recommendations include a "Do Not Use" list of abbreviations and requiring accredited healthcare organizations to provide a written process for managing high-alert and hazardous medications.

Other organizations that work to promote patient safety throughout the medication administration process include the Centers for Disease Control and Prevention (CDC), Poison Control, the National Institutes of Health (NIH), and the FDA. For example, the CDC offers a Medication Safety Program that monitors national data related to adverse drug events as well as other initiatives to support medication safety. Poison Control offers recommendations and assistance in situations of accidental or intentional ingestion or overdose. The NIH support research and funding to develop evidence and best practices for improving medication safety. The FDA centralizes approval of drug names to minimize the confusion among drug names as well as reviews medication labeling, packaging, and product design to identify and minimize potential sources of medication errors. As you can see, safe administration of medications requires a team effort to ensure policies, procedures, and recommendations for evidence-based practice are in place to adequately safeguard the patient.

Patient Identification

According to The Joint Commission's National Patient Safety Goals, at least two patient identifiers are required to correctly identify the patient. The two most commonly used identifiers are full name and date of birth. The patient should be asked to state their name and date of birth, while the nurse confirms the stated identifiers on the patient armband and medication administration record. Other unique patient identifier options include medical record number, phone number, social security number (if noted in medical record), address, or photo. If a patient is unable to verbalize their identity, for instance, they are unconscious, the nurse should verify the patient's identity using a photo ID. It is important to note that room number is not a unique identifier and should not be used to confirm the patient's identity. Although it may seem redundant, it is important to confirm the patient's identity every time medications are administered (The Joint Commission, 2022).

Verifying Order for Errors

The nurse must ensure all parts of the medication order are complete prior to administering medication. If any part of the medication order is missing, there are any questions about the order, or the writing is illegible, the nurse must contact the prescriber to clarify and correct the order. When verifying the medication order for errors, assessing patient allergies is a key safety consideration. If the patient has a documented allergy to the drug ordered, the nurse should provide notification of the allergy to the provider, who will consider alternative drugs and/or treatments.

With implementation of the electronic medical record (EMR), most medication orders are prescribed electronically using **computerized provider order entry (CPOE)** which has reduced the number of medication errors by offering technical safeguards, such as allergy alerts; drug-drug, drug-food, and drug-disease interaction checks; suggestions for safe medication dose ranges and intervals; evidence-based practice order sets; and hard stops to ensure the order is complete. Additionally, CPOE reduces the risk of erroneously transcribing handwritten medication orders.

LINK TO LEARNING

Learn more about the benefits of CPOE (https://openstax.org/r/77benefitscpoe) and its impact on healthcare workflow.

Drug Classification

Drug classification refers to groupings of medication based on how they work (mechanism of action), what they treat (physiological effect), or chemical structure. By grouping like drugs together in classes, expected drug effects of each class may be anticipated, and drug-drug interactions may be predicted for classes of drugs with the same mechanism of action. Drugs from the same therapeutic class are typically assigned names that use the same stem. Table 11.3 displays commonly used stems based on drug classification. Multiple drugs from the same class or those that affect the same organ system should be avoided.

Stem	Definition	Examples
-ac	NSAID (nonsteroidal anti-inflammatory drug)	Diclofen**ac**, bromfen**ac**
-atadine	Antihistamines	Lor**atadine**, olop**atadine**
-axine	Antianxiety, antidepressant	Venlaf**axine**
-azepam	Benzodiazepine antianxiety agent	Lor**azepam**, di**azepam**
-barb-	Antiseizure agent	Pheno**barb**ital, seco**barb**ital
-caine	Local anesthetics	Lido**caine**, Dibu**caine**
-cillin	Beta-lactam antibiotic	Ampi**cillin**, peni**cillin**, oxa**cillin**
-conazole	Antifungals	Flu**conazole**, oxi**conazole**
-cycline	Antibiotics	Tetra**cycline**, mino**cycline**
-dipine	Calcium channel blocker antihypertensive agent	Amlo**dipine**, nicar**dipine**
-dralazine	Vasodilator antihypertensive agent	Hy**dralazine**
-ide	Diuretics	Furosem**ide**, hydrochlorothiaz**ide**
-lol	Beta-blocker antihypertensive	Metoprol**lol**, atenol**lol**
-olone	Steroids	Minax**olone**
-osin	Alpha blockers	Doxaz**osin**, teraz**osin**
-oxacin	Fluoroquinolone antibiotics	Ciprof**loxacin**, dif**loxacin**
-peridol	Antipsychotics	Halo**peridol**
-peridone	Antipsychotics	Ris**peridone**
-pidem	Hypnotics/sedatives	Zol**pidem**, al**pidem**
-prazole	Proton pump inhibitors	Ome**prazole**
-pril	Angiotensin-converting enzyme inhibitor antihypertensive	Capto**pril**, lisino**pril**

TABLE 11.3 Common Drug Classification Stems

Stem	Definition	Examples
-profen	Anti-inflammatory/analgesic	Flurbi**profen**
-sartan	Angiotensin II receptor antagonist (antihypertensive)	Lo**sartan**, val**sartan**
-statin	Renal dehydropeptidase inhibitor, pepsin inhibitor	Pep**statin**, cila**statin**
-terol	Bronchodilators	Albu**terol**
-vastatin	Antihyperlipidemics	Lo**vastatin**, sim**vastatin**
-vir	Antivirals	Ganciclo**vir**

TABLE 11.3 **Common Drug Classification Stems**

Drug Action

Drug action refers to the mechanism in which a drug works. For example, beta blockers block beta adrenoceptors, which blocks the release of adrenaline. As a result, the heart beats slower and with less force, thereby lowering blood pressure, widening the veins, and improving arterial blood flow. Another example are loop diuretics promoting diuresis by blocking reabsorption of sodium and chloride in the proximal and distal tubules, as well as in the loop of Henle. Understanding the drug mechanism of action helps the nurse to understand what occurs within the body once it is administered. The nurse can then anticipate the intended response of administering the medication and report instances in which the drug does not produce the intended effect. For example, the provider should be notified if an antihypertensive does not lower the patient's blood pressure.

Drug Indication

A drug indication refers to the use of the drug for a particular disease or condition. Drugs often have more than one indication. Using a drug for an FDA-approved reason is called a "labeled" indication. In contrast, using a drug for a reason other than that approved by the FDA is referred to as an "off-label" indication. For a drug to have a "labeled" indication, the drug must have been thoroughly researched and shown to be effective in treating the disease or condition. Drugs ordered for "off-label" indications must have demonstrated reasonable evidence to support effectiveness in treating the indication (Ogbru, n.d.). For example, megestrol is a progestin medication that has a "labeled" indication for treating advanced breast and endometrial cancer. Due to the side effect of increased hunger, even with small doses, Megestrol was used "off label" as an appetite stimulant. Once researched and thoroughly studied, the medication is now "labeled" for use as an appetite stimulant. When administering medications, it is important to know and understand what medication the patient is taking, why they are taking it, and to question the provider if it is unclear as to why a drug is ordered.

Medication orders may also contain an indication for administration. For example, medications ordered on a PRN basis must contain an indication for when to administer the medication. Common indications for PRN medications include symptoms such as pain, itching, headache, nausea, or fever. If more than one medication is ordered for the same indication, the order must contain additional details to inform the nurse of when the nurse is to administer each medication. For example, if the patient is ordered Percocet and ibuprofen for pain, the order may state to administer "ibuprofen PRN pain rated 0–5 out of 0/10 scale give ii 200 mg tabs PO Q8 hours" and administer "Percocet PRN pain rated 6–10 out of 0/10 scale give ii 2.5/325 mg tabs PO Q8 hours."

Maintaining a Safe Environment

To ensure safe medication administration, it is critical to maintain a safe environment. One way to maintain a safe environment is by securing medications. All medications must be kept in a locked cart or cabinet. Medications should not be left at the patient's bedside unless there is an order by the provider to do so. Narcotics should be kept in a double-locked cabinet or automated dispensing cabinet (Figure 11.3), counted at the beginning and end of each shift, as well as counted each time the narcotic is accessed. Another way to maintain a safe environment is by restricting access to medications so that only approved staff have access to medications. For example, those approved to administer medications may be granted electronic log-on access or keys to medication carts and

cabinets, whereas those who are not approved to administer medications do not have access to these areas or devices.

FIGURE 11.3 Automated dispensing cabinets provide an electronic means of controlling medication storage, dispensing, and tracking of drugs. (credit: "Pyxis SupplyStation automated dispensing cabinet at Campbell County Memorial Hospital in Gillette, Wyoming" by Mr. Satterly/WTF Public License Version 2)

The nurse must take precautions to safeguard medications once they are gathered from the medication cabinet. This includes gathering and administering medications for only one patient at a time, clearly labeling all prepared medications, and immediately administering medications once they are gathered. If there is a delay in administering the medications, the medications should be returned to the medication cabinet until they are ready to be administered. The nurse should avoid placing patient medications in clothing pockets at any time throughout the medication administration process. This is a risky practice that may result in medication errors (administering medication to the wrong patient or administering the wrong dose), medication damage from body heat, losing or forgetting to administer the medication, and accidental needlesticks.

Safeguards must also be in place when administering "high-alert" drugs, which are drugs that can cause significant harm if an error occurs. Examples of high-alert drugs include insulin, anticoagulants, chemotherapy drugs, and opioids. Automated dispensing cabinets may also include built-in measures to safeguard other high-alert drugs, such as limiting access to the drug, incorporating visual cues such as red text, tall man lettering (Table 11.4) to more easily differentiate similar drug names, or requiring two nurses to enter their credentials to be able to access the medication.

Established Name	Recommended Name
Acetohexamide Acetazolamide	acetoHEXAMIDE acetaZOLAMIDE
Bupropion Buspirone	buPROPion busPIRone
Chlorpromazine Chlorpropamide	chlorproMAZINE chlorproPAMIDE

TABLE 11.4 FDA List of Established Drug Names Recommended to Use Tall Man Lettering (TML)

Established Name	Recommended Name
Cisplatin Carboplatin	CISplatin CARBOplatin
Clomiphene Clomipramine	clomiPHENE clomiPRAMINE
Cyclosporine Cycloserine	cycloSPORINE cycloSERINE
Daunorubicin Doxorubicin	DAUNOrubicin DOXOrubicin
Dimenhydrinate Diphenhydramine	dimenhyDRINATE diphenhydrAMINE
Dobutamine Dopamine	DOBUTamine DOPamine
Glipizide Glyburide	glipiZIDE glyBURIDE
Hydralazine Hydroxyzine	hydrALAZINE hydrOXYzine
Hydromorphone	HYDROmorphone
Medroxyprogesterone Methylprednisolone Methyltestosterone	medroxyPROGESTERone methylPREDNISolone methylTESTOSTERone
Methylprednisolone Methyltestosterone	methylPREDNISolone methylTESTOSTERone
Migalastat Miglustat	migALAstat migLUstat
Mitoxantrone	mitoXANTRONE
Nicardipine Nifedipine	niCARdipine NIFEdipine
Prednisone Prednisolone	predniSONE prednisoLONE
Risperidone Ropinirole	risperiDONE rOPINIRole
Sulfadiazine Sulfisoxazole	sulfADIAZINE sulfiSOXAZOLE
Tolazamide Tolbutamide	TOLAZamide TOLBUTamide
Trazodone Tramadol	traZODone traMADol
Vinblastine Vincristine	vinBLAStine vinCRIStine

TABLE 11.4 FDA List of Established Drug Names Recommended to Use Tall Man Lettering (TML)

LINK TO LEARNING

A complete list of "high-alert" medications (https://openstax.org/r/77highalertmeds) is provided by the ISMP.

Another way to maintain a safe environment is by minimizing distractions and interruptions. Studies have found that

nurses are distracted or interrupted approximately every two minutes. Distractions are a major cause of medication errors, with approximately 75 percent of medication errors being associated with distractions (ISMP, 2012). Common sources of interruptions are people (coworkers, patients, visitors), computers, phones, missing medications, and searching for supplies. Common sources of distractions include phone calls, alarms, pop-up alerts, and life events (e.g., home life, death in the family, finances, buying a house, illness). Intentional efforts to reduce distractions and interruptions in the workplace are important to reduce the risk of medication errors. Examples of intentional efforts to reduce distractions and interruptions include placing a sign on the workstation or patient door to notify others that medication administration is in progress, labeling medication preparation zones as "no talking" zones, and not accepting phone calls when administering medications.

Should a drug administration error occur, actual or potential, it is important to report the situation immediately according to the agency's policy. In the event of an actual error, the patient should be closely monitored for any adverse effects, and the patient's response should be documented. Potential errors are important to report as evaluating these are a means of education for nurses and understanding potential risks. If addressed, potential errors can allow interventions to be implemented to reduce the risk of the situation becoming an actual error in the future.

REAL RN STORIES

Error with an Automated Dispensing Machine

Nurse: RaDonda, RN
Clinical setting: Neuro Intensive Care Unit (ICU)
Years in practice: 14
Facility location: Nashville, Tennessee

It was December 26, 2017, and I was working in the Neuro ICU at Vanderbilt University Medical Center in Nashville, Tennessee. Ms. Charlene Murphey, a 75-year-old female patient, was a bit anxious about an upcoming medical test scheduled that day. Trying to calm Ms. Murphey, I went to the automated dispensing cabinet, typed in V-E, and removed what I thought was Versed. I administered the medication, hoping the sedative would calm Ms. Murphey. Unfortunately, much worse happened.

Instead of removing Versed from the medication cabinet, I removed vecuronium, which is a powerful paralyzer. The effects of this medication were detrimental to Ms. Murphey, causing her to stop breathing and ultimately causing brain damage before the medication error was recognized. I know the reason this patient is no longer here is because of me. There won't ever be a day that goes by that I don't think about what I did (Kelman, 2022).

Even though it was a mistake, I lost my nursing license and was criminally charged with reckless homicide and felony abuse of an impaired adult for the medication error that eventually led to the death of Ms. Murphey. I was sentenced to eight years in prison, which was later overturned to three years of probation. I attribute the mistake to being complacent and distracted while removing medications from the automated dispensing cabinet. Had I took the time to perform the "rights" of medication administration, the medication error would have never occurred, and Ms. Murphey would not have died.

It has since been recommended that the first three letters of the medication name be typed into the automated dispensing cabinet before the medication appears and the nurse can remove it. Since this legal case was nationally publicized, most automated dispensing cabinets have since been programmed with enhanced safety features, including requiring the nurse to type three to five letters of the medication name prior to being able to remove the medication. However, older machines may not have this feature and rely on the prudent nurse to ensure the correct medication is administered.

Adverse Reactions

When unwanted and undesirable effects related to a drug occur, these are called **adverse reaction**s. Unlike **side effects**, which are predictable undesirable effects related to a drug, adverse reactions are unpredictable. Adverse reactions may occur when starting a new drug, stopping a drug, or changing the dose of the drug (FDA, 2022). The incidence and severity of adverse drug reactions may be impacted by factors such as age, sex, genetics, underlying

conditions, drug type, dose, route of administration, and use of other drugs, vitamins, or supplements (Merck & Co., 2023).

Adverse drug reactions may be classified as mild, moderate, severe, and lethal. Mild adverse reactions do not require treatment or prolonged hospitalization. Moderate adverse reactions require a modification of the treatment plan or prolonged hospitalization; however, the drug does not necessarily have to be discontinued. A severe adverse reaction can potentially be life threatening and requires immediate treatment and discontinuation of the drug. A lethal adverse reaction directly or indirectly leads to death (Merck & Co., 2023).

Allergic Reactions

An **allergic reaction** occurs when the immune system responds to a substance, including a drug. Symptoms may include rash, hives, fever, itching, wheezing, runny nose, and watery eyes. A serious drug allergy will typically cause symptoms to appear within one hour after taking the drug. The nurse should notify the provider immediately if the patient develops any symptoms of an allergic reaction. Nurses should remember to always follow the organization's protocol for adverse reactions to a medication.

The most severe type of allergic reaction is **anaphylaxis**. Anaphylaxis is a rare, life-threatening reaction that causes symptoms such as difficulty breathing, nausea, vomiting, diarrhea, dizziness, tachycardia, hypotension, seizure, and loss of consciousness. Anaphylaxis is considered a medical emergency. The nurse should discontinue the drug and urgently notify the provider if anaphylaxis is suspected. The nurse will also initiate emergency protocols according to agency policy.

CLINICAL JUDGMENT MEASUREMENT MODEL

Analyze Cues: Recognizing a Potential Allergic Reaction

The patient reports a new complaint of itching. Although itching is a cue, there is not enough information to analyze the significance of the cue. The nurse may ask the patient additional questions, such as “Is the itching all over or specific to one area of the body?” and “When did the itching start?” as well as perform a physical assessment to learn more about the cue. Upon assessment, it is noted that the patient itches “all over,” the itching started about 10 minutes ago, and there is a newly formed red rash covering the body. Using critical thinking, the nurse considers factors that could potentially cause the symptoms, such as skin conditions, dermatitis from contact with the sheets, or an allergic reaction.

To narrow down a potential hypothesis, the nurse may need to ask additional questions. The nurse asks the patient, “Have you had any recent changes in laundry detergent, diet, or medications?” The patient responds there have been no changes to laundry detergent or diet but does mention that the provider ordered a new antibiotic earlier that morning. The nurse analyzes the medication administration record (MAR) and recognizes the antibiotic was first administered about 40 minutes ago. By recognizing and analyzing the cues of itching, rash, and a new medication order, the nurse forms a hypothesis that the patient may be experiencing an allergic reaction.

Toxic Effect

Drug **toxicity** is the degree to which a drug can be poisonous or harmful to the body. It is a serious event that causes the medication to build up in the body and can often cause harm to the body or even death. For example, digoxin has a half-life of 30 to 40 hours and is excreted via the kidneys. Patients with poor kidney function, such as older adults or those with chronic kidney disease, are more likely to develop a buildup of digoxin that may result in toxicity. As a result, the patient may experience signs of digoxin toxicity, such as gastrointestinal upset, dyspnea, syncope, palpitations, or the appearance of yellow halos around lights. Reasons for drug toxicity may be accidental, such as the dose being too high or slowed metabolism of the drug, or intentional, such as a suicide attempt. If drug toxicity is suspected, the nurse should immediately notify the provider. Typically, in a serum drug level situation, the drug will not be administered until the provider states it is safe to give to the patient. This usually occurs when the amount of the drug in the body has been reduced. Other forms of toxicity occur when a patient has ingested too much medication, often called an overdose. In these situations, treatment options may include stomach lavage or activated charcoal to remove large amounts of the ingested medication (Merck & Co., 2023).

Tolerance

Over time, there can be a decrease in the effectiveness of a drug due to repeated use, this is known as **tolerance**. For example, patients on long-term opioid use due to cancer or chronic pain may require higher doses of opioids over time or additional pain relief therapies to be added to their regimen to adequately treat their pain. It is important to note that tolerance is not the same as dependence, which is when a patient depends on the drug to function. If a patient becomes tolerant to a drug, the provider may need to increase the dose of the drug or use an alternative drug to achieve the desired effect (Merck & Co., 2023).

Drug Interaction

A **drug interaction** is when a drug reacts with another drug, food, supplement, or with the patient's medical condition. This interaction may affect the action of the drug(s) or result in unwanted adverse effects (Figure 11.4). For example, taking opioids and central nervous system depressants together may increase the risk of respiratory depression, while eating leafy greens may decrease the effects of warfarin.

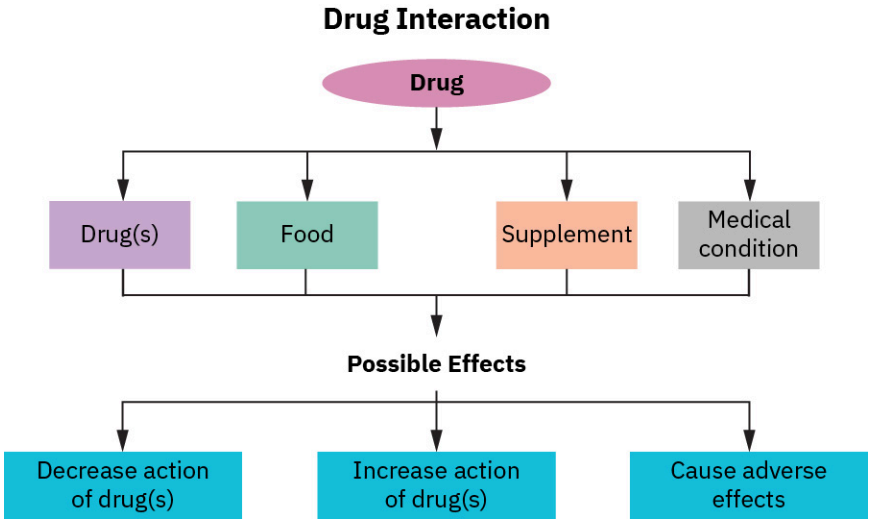


FIGURE 11.4 A drug interaction is a type of adverse reaction that causes undesirable effects. (credit: data source: National Institutes of Health; attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Paradoxical Effect

A **paradoxical effect** occurs when the effect of a drug is opposite from the intended effect. For example, a stimulant causing drowsiness, an antidepressant leading to suicidal thoughts, or a pain relief medication causing increased pain. Paradoxical effects should be documented and reported to the provider for consideration.

Rights of Medication Administration

Nurses are responsible for ensuring patient safety during medication administration. The Rights of Medication Administration are a set of guidelines to adhere to when administering medications in an effort reduce adverse medication events. The five core "rights" of medication administration include the following: right patient, right drug, right route, right time, and right dose. To enhance safety, the American Nurses Association (2021) recommended the addition of right reason, right documentation, and right response (Table 11.5).

Right patient	Validate correct patient by confirming two or more patient identifiers (e.g., patient's full name, date of birth, medical record number). Identifiers must be confirmed verbally by the patient, by the patient wristband, or other acceptable means according to the agency's policy.
Right drug	Compare the medication label to the medication order to ensure correct drug name, note expiration date, and confirm patient allergies.

TABLE 11.5 The Rights of Medication Administration

Right route	Ensure medication is administered via the prescribed method (i.e., oral, sublingual, intravenous). If the route needs to be altered, consult the provider, and obtain a new order.
Right time	Medication is administered according to the prescribed frequency. Confirm when last dose was administered.
Right dose	Confirm dose matches the prescribed dose and is within a safe dosage level. Confirm dosage calculations and question doses outside of the safe dosage range.
Right reason	Confirm why the patient is taking the medication and ensure the mechanism of action aligns with the indication.
Right documentation	Following administration, document the name of the drug, dose, route, time administered, and patient's response to the drug administered.
Right response	Assess if drug resulted in the desired effect.

TABLE 11.5 The Rights of Medication Administration

Bar Code Medication Administration (BCMA) is an electronic scanning system used to decrease the risk of medication administration errors and confirm the "rights" of medication administration (Figure 11.5). By scanning barcodes on the patient's armband and medication labels, the electronic system can confirm that the right patient receives the right dose of the right medication according to the right frequency. BCMA also provides additional alerts, such as when vital signs need to be assessed prior to administering a medication, allergies are present, or a second nurse needs to verify the medication.

FIGURE 11.5 Nurses use Bar Code Medication Administration to assist with confirming the "rights" of medication administration. (credit: "20130306-OC-RBN-3904 (8575102671).jpg" by Bob Nichols/U.S. Department of Agriculture, Public Domain)

The five core "rights" of medication administration (right patient, right drug, right route, right time, and right dose) should be confirmed at three different checkpoints during the medication administration process. These three checkpoints are when obtaining the medication, when preparing the medication, and when administering the

medications at the bedside. At each of the checkpoints, the medication label should be compared to the medication order to confirm the right patient, right drug, right route, right time, and right dose.

In addition to checking the basic rights of medication administration and documenting the administration, it is important for nurses to verify the following information to prevent medication errors:

- Right history and assessment. The nurse should be aware of the patient's allergies as well as any history of any drug interactions. Additionally, nurses collect appropriate assessment data regarding the patient's history, current status, and recent laboratory results to identify any contraindications for the patients to receive the prescribed medication.
- Right drug interactions. The patient's history should be reviewed for any potential interactions with medications previously given or with the patient's diet. It is also important to verify the medication's expiration date before administration.
- Right education and information. Information should be provided to the patient about the medication, including the expected therapeutic effects as well as the potential adverse effects. The patient should be encouraged to report suspected side effects to the nurse and/or prescribing provider. If the patient is a minor, the parent may also have a right to know about the medication in many states, depending on the circumstances.
- Right of refusal. After providing education about the medication, the patient has the right to refuse to take medication in accordance with the Nurses Code of Ethics and respect for individual patient autonomy. If a patient refuses to take the medication after proper education has been performed, the event should be documented in the patient chart and the prescribing provider notified.

11.2 Dosing

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Define common systems of measurements
- Perform mathematical calculations to solve dosage equations
- List the stages of the nursing process for safe dosing

Medication administration involves ensuring the right dose of medication is administered to the patient. Medication calculations are an important skill for the nurse to perform correctly to ensure the patient receives the right dose. Miscalculating drug dosages is a frequent source of medication administration errors (Tariq et al., 2023). To provide safe administration of medications, it is important for the nurse to be aware of the various systems of measurement and to be equipped with the skills to perform accurate calculations. These skills will help the nurse to be confident in their ability to calculate medication dosages.

Systems of Measurement

Collections of measurement units and how they are associated with one another are known as **systems of measurement**. These collections of measurement are based on a standard reference point. Without a measurement standard, there is an increased likelihood of incorrect measurements. There are three systems of measurement used for drug dosages: the metric system, household system, and apothecary system.

Metric System

The **metric system** is the most widely used international system of measurement and is considered to be the most accurate of the three systems of measurement. It is a decimal-based system based on units of 10. The gram is used to measure weight, liter is used to measure volume, and meter is used to measure length. Table 11.6 displays metric measurements and their equivalents. Though the FDA recommends using milliliter (mL) as the standard measurement for liquid medications, it is important to note that you may still see cubic centimeter (cc) used in practice. Should you see "cc" used, 1 cc is the equivalent of 1 mL.

Measurement	Equivalent
Weight	
1 kilogram (kg)	1,000 grams (g)
1 gram (g)	1,000 milligrams (mg)
1 milligram (mg)	1,000 micrograms (mcg)
Volume	
1 liter (L)	1,000 milliliters (mL)
1 milliliter (mL)	1 cubic centimeter (cc)
Length	
1 kilometer (km)	1,000 meters (m)
1 meter (m)	100 centimeters (cm)
1 centimeter (cm)	10 millimeters (mm)

TABLE 11.6 Metric Measurements and Equivalents

Household

The **household system** utilizes everyday household items, such as measuring cups and tablespoons, to serve as measuring devices. Due to variations in the size of household items, it is considered to be the least accurate system of measurement. Table 11.7 displays common household units and their equivalent conversions.

Measurement	Equivalent
1 cup	8 ounces (oz) = 16 tablespoons (tbsp or T)
2 tablespoons (tbsp or T)	1 ounce (oz)
3 teaspoons (tsp or t)	1 tablespoon (tbsp or T)
1 teaspoon (tsp or t)	60 drops (gtt)

TABLE 11.7 Household Measurements and Equivalents

Apothecary

The **apothecary system** utilizes fractions as a part of the whole to measure weights and volumes. Due to the confusion that may arise with the use of fractions, the ISMP recommends using the metric system for medications. Although the apothecary system is not frequently used today, there are some providers who may continue to use apothecary measurements in their orders. Table 11.8 displays frequently used apothecary weight and volume measurements and their equivalents.

Measurement	Equivalent
Weight	
1 pound (lb)	16 ounces (oz)
1 ounce (oz)	8 drams (dr)
1 dram (dr)	60 grains (gr)
Volume	
1 gallon (gal)	4 quarts (qt)
1 quart (qt)	2 pints (pt)
1 pint (pt)	16 ounces (oz)
1 ounce (oz)	8 fluid drams (fl dr)
1 fluid ounce (fl oz)	1 ounce (oz)
1 fluid dram (fl dr)	1 dram (dr)

TABLE 11.8 Apothecary Measurements and Equivalents

Dosage Calculations

Dosage calculations are critical skills for the nurse to develop. The nurse must know how to accurately calculate drug dosages to ensure the correct amount of the drug is administered to the patient. Accurately calculating dosages enhances patient safety and reduces the risk of drug errors and potential harm. Dosage calculations may require units of measurement to be converted to a different system of measurement as well as dosages to be determined according to the patient's weight or serum levels. This section prepares you with the knowledge needed to confidently perform dosage calculations.

Conversion Between Systems

Medications may be prescribed using one system of measurement and supplied in a form that uses a different system of measurement. When this occurs, the prescribed measurement must be converted to the supplied measurement. This calculation may involve converting a metric system measurement into a household measurement or a household measurement into an apothecary measurement. To be able to accurately calculate the dosage, the nurse must be aware of common conversion factors (Table 11.9).

1 kg	2.2 lb
1 tsp	5 mL
1 oz	30 mL
1 tbsp	15 mL
2 tbsp	1 oz

TABLE 11.9 Common Conversion Factors

1 cup	8 fl oz
1 lb	16 oz
8 oz	240 mL
1 pt	500 mL
1 gtt	0.5 mL

TABLE 11.9 Common Conversion Factors

Dimensional Analysis

A factor-label method for solving dosage calculations is called **dimensional analysis**. Factors are simply another name for the unit of measurement. The goal of dimensional analysis is to set up the known information (such as amount ordered, amount supplied, and quantity supplied) in a way that like units of measurement (factors) cancel each other out so the dose is remaining. Dimensional analysis allows all calculations to be solved using the same method without having to memorize formulas, which reduces the risk of calculation errors.

To solve, the desired dose is placed over one and then cross multiplication is used to determine the dose. If the dose ordered and dose supplied are not the same unit of measurement, a conversion factor may be added to the equation. To simplify the equation, zeros may be canceled out, and fractions may reduce to the smallest form. When calculating medication dosages, rounding should not occur until calculating the final answer. When it is possible to administer a fraction of a dose, medications are typically rounded to the nearest tenth for adults and to the nearest hundredth for children, unless otherwise indicated by the agency's policy.

Example:

> Order: Alprazolam (Xanax) 1,000 mcg PO Q8 hours
> Supplied: Alprazolam (Xanax) 0.25 mg tablets
> Calculation: $1{,}000\ \cancel{\text{mcg}}/1 \times 1\ \cancel{\text{mg}}/1{,}000\ \cancel{\text{mcg}} \times 1\ \text{tablet}/0.25\ \cancel{\text{mg}} = \text{tablets/dose};$
> $= (1{,}000 \times 1 \times 1)/(1 \times 1{,}000 \times 0.25);\ = 1{,}000/250 = \mathbf{4\ tablets}$

Example:

> Order: Potassium chloride (KCl) 60 mEq PO Q6 hours
> Suppled: KCl 40 mEq/15 mL
> Calculation: $6\ \cancel{0\ \text{mEq}}/1 \times 15\ \text{mL}/4\ \cancel{0\text{mEq}} = \text{mL/dose};\ = (3/1) \times (15/2);\ = 45/2 = \mathbf{22.5\ mL\ per\ dose}$

LINK TO LEARNING

Watch a demonstration of how to perform dimensional analysis (https://openstax.org/r/77dimanalysis) in this video.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Calculating Medication Dosages

See the competency checklist for Calculating Medication Dosages. You can find the checklists on the Student resources tab of your book page on openstax.org.

Formula Method

The **formula method**, sometimes referred to as the "desired over have method," divides the desired amount by the amount on hand, then multiplies it by the quantity on hand to determine the dose. The desired amount (*D*) is the dose prescribed, the amount on hand (*H*) is the available dose or concentration, and the quantity (*Q*) is the form and

amount in which the drug is supplied.

$$\frac{\text{D (desired amount)}}{\text{H (amount on hand)}} \times \text{Q (quantity)} = \text{Dose}$$

Examples:

Order: Amoxicillin (Amoxil) 500 mg PO Q8 hours
Supplied: 250 mg tablets
Calculation: $\boldsymbol{D/H \times Q} = 500 \text{ ~~mg~~}/250 \text{ ~~mg~~} \times 1 \text{ tablet} = 2 \times 1; = \mathbf{2 \text{ tablets}}$

Order: Morphine (Duramorph) 1 mg IV Q2 hours PRN severe pain
Supplied: 2 mg vials
Calculation: $\boldsymbol{D/H \times Q} = 1 \text{ ~~mg~~}/2 \text{ ~~mg~~} \times 1 \text{ vial} = 0.5 \times 1; = \mathbf{0.5 \text{ vial}}$

Ratio Proportion Method

A **ratio** is a comparison of one quantity to another, often described as a division problem. Ratios can be expressed as a fraction (1/4) or as a ratio (1:4). A proportion is an equation of two ratios that are equal. Proportions can be expressed as 1/4 = 2/8 or 1:4 is proportional to 2:8.

When using the **ratio proportion method**, the known ratio of drug amount to quantity is set equal to the desired amount to the unknown quantity. This proportion may be displayed as $H/Q = D/x$ or $H:Q::D:x$. To solve, cross multiply and solve for x. In doing so, the equation becomes $Hx = DQ$, which can then be solved by dividing DQ by H ($x = DQ/H$).

$$\frac{\text{H (have on hand)}}{\text{Q (quantity)}} = \frac{\text{D (desired amount)}}{\text{x}}$$

Examples:

Order: Guaifenesin (Mucinex) 400 mg PO Q4 hours
Supplied: 200 mg tablets
Calculation: $\boldsymbol{H/Q = D/x;}\ 200 \text{ mg}/1 \text{ tablet} = 400 \text{ mg/x}; 200\text{x} = (400 \times 1); \text{x} = (400/200); \text{x} = \mathbf{2 \text{ tablets}}$

Order: Ketorolac (Toradol) 15 mg IM Q6 hours
Supplied: 30 mg/mL vial
Calculation: $\boldsymbol{H/Q = D/x;}\ 30 \text{ mg}/1 \text{ mL} = 15 \text{ mg/x}; 30\text{x} = (15 \times 1); \text{x} = (15/30); \text{x} = \mathbf{0.5 \text{ mL}}$

Weight-Based Dosages

Weight-based dosages are ordered as a certain amount of drug based on the patient's body weight. When calculating weight-based dosages, it is important to note that body weight is based on kilograms. If the weight is documented in pounds, it will need to be converted to kilograms before completing the calculation, or the conversion may be accounted for by using dimensional analysis.

Example:

Order: Amoxicillin (Amoxil) 40 mg/kg/day PO BID
Supplied: 400 mg/5 mL
Weight: 66 lb
Calculation:

Step 1: Convert pounds to kilograms	$66 \text{ ~~lb~~} \times 1 \text{ kg}/2.2 \text{ ~~lb~~} = 30 \text{ kg}$
Step 2: Calculate the dose in milligrams	$30 \text{ ~~kg~~} \times 40 \text{ mg}/\text{~~kg~~}/\text{day} = 1{,}200 \text{ mg/day}$

Step 3: Divide the dose by the frequency	1,200 mg/day / 2 (BID) = 600 mg/dose
Step 4: Convert the milligrams to milliliter	600 mg/dose = 400 mg/5 mL; x = (600 ~~mg~~ × 5 mL)/400 ~~mg~~ = (3,000/400) = **7.5 mL per dose**

Using dimensional analysis:

66 ~~lb~~/1 × 1 ~~kg~~/2.2 ~~lb~~ × 40 ~~mg~~/1 ~~kg~~ × 5mL/400 ~~mg~~ = mL/day;
(66 × 1 × 40 × 5)/(1 × 2.2 × 1 × 400)
= (13,200/880) = 15 mL/day; 15 mL/2 doses = **7.5 mL/dose**

Serum Drug Level Dosing

Serum drug level dosing, also known as therapeutic drug monitoring, allows the medication to be dosed according to the amount of drug found in the blood system. This type of dosing is sometimes necessary to ensure safe and effective levels of medications are prescribed. Serum drug level dosing is typically indicated when there is a known relationship between the drug and the serum level, a narrow therapeutic window, high variability in pharmacokinetics, or potential for severe dose-related adverse effects.

Movement of drug molecules within the body based on how the drug is distributed, metabolized, absorbed, or excreted is known as **pharmacokinetics**. Common drugs that require serum drug level dosing include antiepileptics (phenobarbital, phenytoin, valproic acid), anti-arrhythmics (digoxin, procainamide), antibiotics (vancomycin, gentamycin), antimanics (lithium), bronchodilators (theophylline), and immunosuppressants (cyclosporine, tacrolimus).

Nursing Process for Safe Dosage

The nursing process provides a systematic guide for nurses to deliver optimal care. This framework encourages critical thinking and may be applied to all facets of nursing care. This section examines how the nursing process may be applied to clinical practices to ensure safe medication dosages are accurately calculated and administered.

Assessing

The first step of the nursing process is assessment. During the assessment phase, the nurse collects data and utilizes critical thinking skills. For example, the nurse checks the medication record and makes sure the patient's diet and fluid orders do not interact; for medication administration when a patient is NPO, the nurse looks at the patient's ability to swallow and checks labs that may affect whether to give medication or not. Using the nursing process for safe dosing, the nurse collects data from the medication order. The data needed to safely dose the medication include the drug name, dosage, route, frequency, and any administration instructions. For example, the nurse may assess that the order is for furosemide (Lasix) 40 mg PO Q12 hours.

Diagnosing

Diagnosing involves utilizing clinical judgment to form a diagnosis that can be used for care. Within medication dosing, diagnosis occurs when the nurse identifies how the medication is supplied. Using the same example, the nurse determines that furosemide (Lasix) is available in 20 mg tablets.

Outcome Identification

Once the problem has been diagnosed, the next step in the nursing process is to identify the intended outcome, or goal. The intended outcome in relation to medication dosing is the amount of medication to be administered to the patient. For example, we could use the ratio proportion method to determine the following medication calculation: 20 mg/1 tablet = 40 mg/x; 20x = (40 × 1); x = (40/20); x = 2 tablets. Through this calculation, it is determined the outcome (goal) is to administer 2 tablets of furosemide (Lasix). The formula method ($D/H \times Q$) could also be used: 40 ~~mg~~/20 ~~mg~~ × 1 tablet; = (2 × 1); = 2 tablets.

Planning

The planning phase involves formulating a plan to achieve the intended goals and outcomes. For example, when calculating the required dose, the nurse may make a mental note or write down that two tablets of furosemide (Lasix) are needed instead of just one. In other cases, the nurse may recognize that additional supplies are needed

to ensure the proper dose, such as a pill splitter, syringe, or measuring cup.

Implementing

Once a plan is in place, the next step is implementation. In the case of medication dosing, the planning phase involves the nurse collecting and preparing the required dose. For example, the nurse goes to the patient's medication drawer or automated dispensing cabinet and removes two tablets of furosemide (Lasix). While preparing the medication, the nurse recalls the "rights" of medication administration by double-checking to ensure it is the right medication, right dose, right frequency, and right route for the right patient.

Evaluating

Evaluation is a critical component of the nursing process. Within this phase, the nurse should assess the intervention to ensure the desired outcome was achieved. Prior to administering the dose, the nurse must ensure the accurate dose was prepared. The first step in evaluating safe dosages is to confirm the medication calculations. You may ask yourself, "Does this dose make sense?" "Was the calculation set up so that units of measurement were canceled out?" and "Was the correct conversion factor used?" If ever in doubt, ask a colleague to double-check the calculation to ensure the dose is accurate. The pharmacist is another excellent resource when questions arise, especially if the pharmacist's calculations differ from those of the nurse. Many times, the pharmacist is available on the specific nursing units.

Patient Education

Patient education is not only a provisional standard of nursing care, but it is also important for enhancing the patient's knowledge and understanding of their health as well as an explanation of why certain care is being provided. Not only does patient education engage the patient in their care, but it can also reduce errors and improve patient outcomes. For example, the nurse may educate the patient that the provider ordered 40 mg of furosemide (Lasix), the pharmacy only supplies 20 mg tablets, therefore two tablets are being administered to equal the ordered dose. After receiving this education, the patient is then better equipped with an understanding of their dose and may question the nurse if only one tablet is administered next time.

PATIENT CONVERSATIONS

Educating Patients on Safe Dosages Prior to Discharge

Nurse: Mrs. Fisher, your provider is sending you home with a prescription for Lasix. Lasix is the "water pill" that you have been getting here in the hospital to help reduce your swelling.

Patient: Oh, that's the one that makes me go to the bathroom all the time.

Nurse: Yes, Lasix does increase the frequency of urination. Your provider would like you to take 40 mg of Lasix by mouth every 12 hours once you go home from the hospital.

Patient: 40 mg? Is that what I've been taking since I've been here?

Nurse: Yes, you have been taking 40 mg of Lasix at 6 a.m. and again at 6 p.m. Here in the hospital, we have been giving you two 20 mg tablets to equal the 40 mg that was prescribed. However, once you leave the hospital, you will need to carefully review the information on the prescription label to determine how many pills to take with each dose at home. If the pharmacy gives you 20 mg tablets, then you will take two tablets with each dose. However, if the pharmacy gives you 40 mg tablets, you will only need to take one tablet with each dose. It is important that you take the correct number of tablets to ensure you are getting the right dose of medication. What questions can I help to answer?

Patient: I don't have any questions at this time.

Nurse: Just to recap, Mrs. Fisher, if the pharmacy supplies you with 40 mg tablets, how many tablets would you take with each dose?

Patient: I would only need to take one pill each time.

11.3 Documentation of Medication Administration

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the nursing guidelines for documenting medication administration
- Explain the importance of accuracy in documentation of medication administration
- Demonstrate how to correctly document in a medication administration record (MAR)

Documentation of medication administration is part of the patient's legal medical record. Not only does the documentation play a critical role in clinical decision-making, but it may also be used in situations when legal action might be initiated. For these reasons, it is critical that this documentation be accurate, complete, reliable, and timely. This section prepares you with the knowledge and skills to accurately document medication administration in the patient's medical record.

Nursing Guidelines for Documentation of Medication Administration

After completion of administering medications, the nurse is responsible for documenting the medication administration as well as any required postadministration assessments. This step is the one in which the medication administration "rights" of right documentation and right response are verified. To ensure accurate documentation, guidelines have been developed to ensure that only approved abbreviations are used, documentation is timely, and there is adequate evaluation of the patient's response to the medication.

Approved Abbreviations

When documenting medication administrations, it is important to use only approved abbreviations to avoid potential medication errors. Agencies should incorporate standardized abbreviations to ensure consistency and reduce confusion. Using data from the ISMP's National Medication Errors Reporting Program, there are a number of error-prone abbreviations that have been linked to medication errors, which should be considered when creating standardized abbreviations. Although these abbreviations are suggestions for agencies to strongly consider avoiding, The Joint Commission's published list of "Do Not Use" abbreviations that must be avoided should be incorporated into the organization's "Do Not Use" list.

To avoid confusion, medication names should typically be spelled out in full. For example, abbreviations for hydrocortisone (HCT) and hydrochlorothiazide (HCTZ) may be mistaken. Likewise, oxytocin (OXY) may be mistaken for oxycodone or oxycontin. Although the decision of whether using abbreviations is allowed is at the discretion of individual agencies, certain abbreviations should never be used based on evidence-based standards and implemented regulations by accrediting agencies. For instance, the abbreviations for magnesium sulfate ($MgSO_4$) and morphine sulfate (MSO_4) must never be used due to the high risk of significant negative patient outcomes should an error occur. Medications that are enteric-coated may include EC to the right of the drug name, whereas extended-release medications may use ER or XR, and sustained release may use SR. You may also see antibiotics generally referred to as abx; however, documentation of the medication administration should list the antibiotic name in full.

When expressing dosages, it is best practice to avoid fractions and roman numerals. Fractions may be misinterpreted as a range, and roman numerals may be mistaken as a letter or the wrong number. For example, "1/2 tablet" may be mistaken as "1–2 tablets," and "V" may be mistaken as the letter *V* or 10. Instead, using "half tablet" and "5" reduces the risk of confusion and error. Remember that trailing zeros should be avoided, and leading zeros should be used before a decimal point. For example, use 5 mg instead of 5.0 mg, as 5.0 mg may be mistaken for 50 mg. Likewise, use 0.25 mg instead of .25 mg, as .25 mg may be mistaken for 25 mg. Adequate space must be placed between the drug name, dose, and unit of measurement to avoid misinterpretation. For example, metoprolol 25 mg may be mistaken as metoprolol 125 mg without the necessary space between the medication name and dose, or it may be mistaken as 2500 g without the necessary space between the dosage amount and unit of measurement. Another best practice is to use commas when numbers are greater than one thousand. For example, use 100,000 units instead of 100000 units, which may incorrectly be transcribed as 1000000. Careful consideration should also be given to the measurement units. For example, use mL for milliliter instead of ml or cc; L for liter instead of l; units instead of IU, U, or u; and mcg for micrograms instead of µg. Drops may be expressed as gtt.

When expressing medication routes, writing out the route in full is the best way to avoid mistakes. However, some

agencies may allow abbreviations for the route, such as right ear (AD), left ear (AS), each ear (AU), right eye (OD), left eye (OS), and each eye (OU). If agency policy allows other abbreviations for routes, these may include NAS (intranasal), PO (oral), SUBQ (subcutaneous), IM (intramuscular), IV (intravenous), IVP (intravenous push), and IVBP (intravenous piggyback). In addition, some medications, such as injections, require the administration site to be documented. For instance, right arm (RA), left arm (LA), right leg (RL), left leg (LL), right lower extremity (RLE), left lower extremity (LLE), right lower quadrant (RLQ), left lower quadrant (LLQ), and abdomen (abd).

When expressing frequency, writing the frequency in full (i.e., daily, at bedtime, daily at 8 AM, 4 times daily) is safest. "Q" is often used to denote "every." For example, daily may be written as QD or Q1d, but writing out "daily" is recommended. Similarly, orders may be written in terms of every so many minutes, hours, days (i.e., Q30 min, Q6h, Q2d). Nightly at bedtime may be abbreviated as HS or QHS; however, the ISMP recommends using just HS, nightly, or to spell out "at bedtime." Medication frequency may also be expressed in relation to meals; for example, before meal (ac), after meals (pc), and before meals and at bedtime (achs).

Typically, symbols are not recommended when documenting medications. Instead of using > and <, best practice is to spell out the words *more than* and *less than*. Similarly, it is better to write out *increase* and *decrease* rather than to use directional arrows. Other symbols, such as @ and & may be mistaken as a 2 when handwritten, and + may be mistaken as a 4. Therefore, it is better to use the words *at*, *and*, *plus*, or *in addition to*. Weights should be stated as lb or kg instead of # to avoid confusion of whether the symbol is referring to a number or to pounds.

LINK TO LEARNING

View The Joint Commission's Do Not Use List Fact Sheet (https://openstax.org/r/77donotuselistu) here. View the Institute for Safe Medication Practices' List of Error-Prone Abbreviations (https://openstax.org/r/77errorproneabb) here.

Timing of Documentation

Medications should be documented immediately after they are administered. Documenting at the time of administration reduces the potential for error and helps to ensure the most accurate documentation. It also reduces the likelihood of duplicate administration and may alert the clinician to changes in the patient's condition.

Medication administration should not be documented prior to the administration, as the patient's current condition may impact the ability to administer the medication. For example, the nurse may document the IV medication before administration, only to find the IV had infiltrated upon entering the patient's room. Other examples may include documenting oral medications before administration, only to find the patient cannot safely swallow, or documenting that a medication was given, only for the patient to refuse the medication when it is administered. Not only may the patient's condition change, but there is also a risk of the nurse documenting the administration of the medication and then forgetting to administer the medication.

Evaluation of Medication

After administering medications, it is important for the nurse to ensure the medication had the intended outcome, as part of the nursing process. For instance, did the patient's blood pressure decrease after administering blood pressure medication? Did the patient's fever decrease after administering a fever reducer? If the medication did not result in the intended outcome, it is important for the nurse to report the patient's response, or lack thereof, to the provider, as well as document the response in the patient's chart.

The timing of this evaluation depends on the onset of the medication. Typically, oral medications should be evaluated within 30 minutes to one hour after administration, whereas IV medications should be assessed much sooner. Depending on the medication administered via the IV route, evaluation can occur from five minutes to 15 minutes after administration. Although these are guidelines, the nurse should follow the agency's policies regarding time frame for evaluation of medications.

In addition to the intended response, the nurse should document any noted adverse reaction following the administration, including any allergic responses. For example, the nurse may note a rash on the patient's body 30 minutes after administering a new medication. The nurse should document the patient's reaction to the medication

within the medication administration record (MAR) and write a progress note detailing the patient's response to the medication. The progress note should also include a statement that the provider was notified and any additional orders that may have been received.

Medications administered on a PRN basis must also be evaluated. When administering the medication, the indication for the PRN medication must be clearly identified. For example, if Benadryl is administered PRN itching, the nurse must document the assessment findings related to the itching. If the medication is being administered for pain, then a pain assessment must be performed and documented. The nurse must also reassess the PRN indication according to the medication's onset, documenting the patient's response. For example, if an oral pain medication is administered, the nurse may reassess the pain about 30 minutes to one hour after administering pain medications, whereas the patient's pain should be assessed within 10–15 minutes after administering an IV pain medication.

Accuracy of Documentation

Thorough and accurate documentation is critical for clinical decision-making and the delivery of high-quality care. The patient's medical record serves as a communication tool for the interdisciplinary team and is crucial for ensuring continuity of care. Not only does accurate documentation inform the care team of the patient's current situation and allow for treatment decisions to be made, but it also provides legal evidence that may be used in the court of law. Therefore, accurate documentation is needed to provide the very best care and to mitigate risks.

Patient Refusal of Medication

Patients have rights, including the right to refuse medications. Should the patient refuse a medication, the first step is to determine why the patient is refusing the medication. Once the reason for refusing the medication has been determined, the nurse can then plan how best to proceed. For example, the nurse may determine the patient is refusing the medication because at home they typically take the medication at night instead of in the morning. The nurse may then collaborate with the pharmacy to reschedule the dose for nighttime. Or perhaps the patient experiences difficulty swallowing. The patient may refuse to take the medications whole but is amenable to taking the medications crushed in applesauce.

Within this assessment, the nurse should also understand why the medication is necessary. There may be times when patients lack the capacity to make sound decisions. It is important to consider if the patient has the capacity to fully understand the implications and make an informed decision to refuse the medication. For example, some mental health conditions such as dementia, conditions that cause a lack of consciousness, and intoxication may prohibit the patient from being fully aware of the implications of their decisions. Another instance may be children refusing medication out of fear without being able to fully make an informed decision. Although the child may not want to take the medication, the decisional capacity lies within the caregiver to provide consent.

It is important to listen to the patient, identify their concerns, ask questions to better understand the patient's perspective, and provide clarity to ensure the patient is appropriately informed. The nurse may express a different viewpoint of the situation; however, the nurse should avoid arguing with the patient or minimizing the patient's concerns. It may also be helpful to provide the patient with options, when possible, to allow the patient more control over the situation. For example, the patient may refuse a suppository but be amenable to taking an oral form of the medication. Another strategy may be to include the patient's family or caregiver. For example, the patient may refuse medications administered by the nurse but will take the medications if administered by a trusted family member.

There may also be times where an alternative is not possible. In these cases, it is crucial to educate the patient. This education may include why the medication was prescribed, the benefits, as well as potential health outcomes if the medication is not administered. By educating the patient, the patient may make an informed decision to refuse the medication. Another strategy may be to give the patient time to consider the decision and then follow up with the patient a few minutes later to see if they have reconsidered taking the medication.

PATIENT CONVERSATIONS

What If Your Patient Refuses a Medication?

Nurse: Mr. Blackwell, I see your breakfast arrived, so I went ahead and brought your insulin.

Patient: I'm not taking insulin.

Nurse: Can you tell me a little bit about why you don't want to take it?

Patient: I don't take insulin at home. I take metformin at home, which I've already had today.

Nurse: I do see the metformin listed here on your home medication list; however, your provider would also like for you to take insulin while you are here in the hospital. Factors such as stress, surgery, and antibiotics are known to increase blood sugar levels. Therefore, the insulin is used in combination with your metformin to better control your blood sugar since you just had surgery and are on antibiotics.

Patient: I know what increases blood sugar levels; however, I'm still not taking insulin.

Nurse: Mr. Blackwell, can you tell me what your blood sugar typically runs at home?

Patient: About 114.

Nurse: This morning, your blood sugar is 152. It likely increased due to having surgery yesterday, the antibiotics, and overall stress on your body. The insulin will help to bring your blood sugar down to your normal range. We use a sliding scale, so we can tailor the insulin dosage according to your blood sugar level.

Patient: Maybe so, but I'm still not taking it.

Nurse: Mr. Blackwell, I understand you don't take insulin at home, and you seem to understand that your blood sugar may be higher than usual. Can you help me to better understand why you don't want to take insulin?

Patient: I'm afraid if start taking it now that the doctor will want to keep me on it when I go home.

Nurse: I appreciate your concern; however, the intent is not to send you home with insulin. It is intended to help control your blood sugar just while you are here in the hospital. When you go home, you will go home on your usual metformin.

Patient: I'm still not taking it.

Nurse: I will let your provider know of your concern with taking insulin. Given your blood sugar is higher than normal, you may consider limiting food and drink high in sugar and carbohydrates to provide the best control over your blood sugar. Do you know what carbohydrates are?

Patient: Yes, things like potatoes, crackers, pasta . . . all of my favorite foods.

Nurse: While they may be your favorite foods, avoiding them right now is necessary if you want to try to avoid insulin.

Patient: I understand and will certainly watch what I eat and drink. No soda or spaghetti for me.

If the patient refuses a medication, it is important to notify the provider and chart the refusal. This may include documenting the refusal in the MAR, as well as writing a nursing note in the chart that clearly states the patient's capacity for decision-making, rationale for the refusal, education provided, and other actions taken by the nurse (including notifying the provider) (Figure 11.6). Any direct quotes provided by the patient should be included within the note; however, be cautious that the patient's exact words are used if quotation marks are used.

Patient: Rose Sanchez **Age:** 40	**Date of Birth:** 04/18/1983 **Room:** 366M	**Medical Record Number:** 008222014

Date/Time	Document	Signature
02/10/2023 Time: 08:03 AM	Patient refused Lovenox. Patient is alert and oriented times three. Patient stated, "I don't like needles." Nurse explained that Lovenox was prescribed to reduce the risk of blood clots following surgery, what to expect with the administration, and that the medication was ordered once a day. Patient handout on Lovenox provided to patient. Patient verbalized understanding of importance of the medication, as well as the risk of getting a blood clot post-operatively. Discussed alternative means of reducing the risk of blood clots, such as frequent walking, performing leg exercises when lying in the bed, and wearing the sequential compression devices (SCDs)/ TED hose. Patient verbalized understanding of instructions and agreed to adhere to the alternative measures. Provider notified. No new orders were given.	Jennifer Bass, RN
02/10/2023 Time: 09:12 AM	Patient ambulated in the hallway for 15 minutes. TED hose and SCDs placed upon arrival back to patient's room. Nurse asked if patient had reconsidered taking Lovenox. Patient again refused medication and agreed to ambulate again in 1 hour. Will continue to encourage ambulation and SCDs/TED hose.	Jennifer Bass, RN

FIGURE 11.6 Sample of nursing note to document patient refusal of medication. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Correcting an Error in Documentation

Errors in documentation should be corrected as soon as they are noticed, and the manner depends on whether the documentation is in electronic or paper format. If the medication is documented electronically, you can typically correct the error by clicking on the medication administration tab within the MAR and then proceed to edit the documentation. Although the electronic chart may be updated daily, most electronic medical records keep a log of all edits made. Although errors should be corrected when they occur, corrections should not be a common occurrence and may indicate too many distractions, or the nurse may need to pay closer attention to the task at hand.

When documentation is handwritten on paper, mistaken entries may be noted by drawing a single line through the error, along with the date and your initials. It is important to use only one line to strike through the error. Do not use multiple lines, squiggly lines, Wite-Out, or attempt to erase the error.

Medication Administration Record

The **medication administration record (MAR)** is used to document medication administration. The MAR is a comprehensive record that tracks the medications that have been administered, the dose, the route, the time administered, any instructions that were provided, who administered the medication, and who ordered the medication. It should also list the indication for PRN medications, the effectiveness of PRN medication, and any medication reactions noted.

The **electronic medication administration record (eMAR)** is electronically populated according to the provider's orders and often automatically populates much of the necessary documentation, such as the drug, route, PRN indication, provider's name, and name of the person administering the medication (based on the log-on information provided). Typically, the time is defaulted to real time (as medications should be administered in real time); however, the nurse may alter the time, if needed. The eMAR provides additional layers of safety, such as displaying

administration instructions, prompts when additional assessments are required, and pop-up alerts to notify the nurse of potential problems, such as contraindications, allergies, the administration being too close to another administration, or that the medication has been discontinued (Figure 11.7). Although the eMAR is convenient and offers a multitude of safety features, it is important for the nurse to use their own clinical judgment when documenting medication administrations and not become reliant on the eMAR.

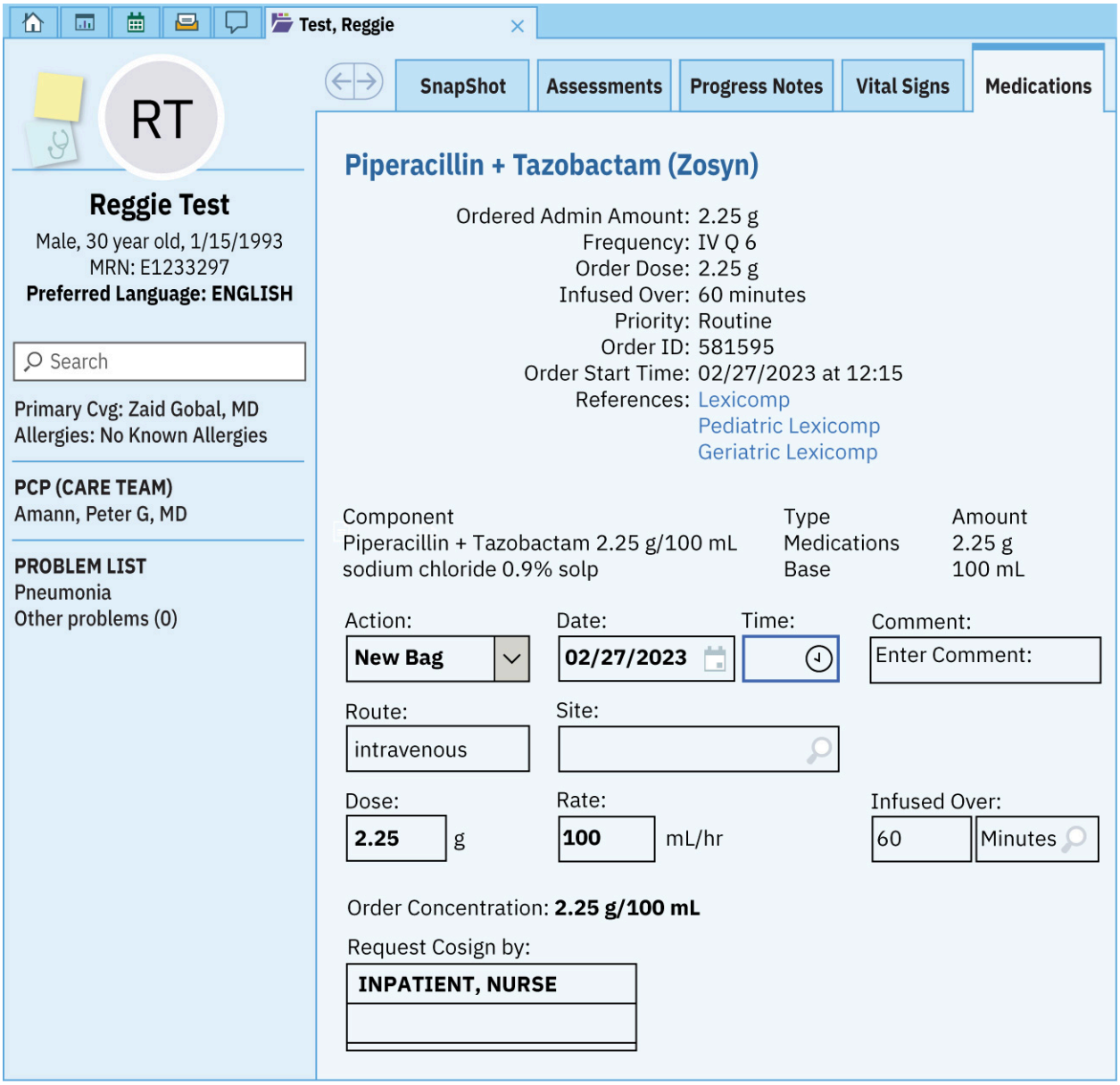


FIGURE 11.7 Example of documenting medication administration in the eMAR. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

The nurse must also know how to document medication administrations via a paper MAR (Figure 11.8), as some agencies do not use eMARs, and those that do are subject to "downtime" in which the eMAR may not be available. When using a paper MAR, the medication order information, such as medication name, dose, route, frequency, prescriber name, and order date and time, must be accurately transcribed for each medication order, followed by the time in which the medication should be administered. Each MAR displays a particular time frame, typically for as much as one month, with the dates of the month typically indicated horizontally across the top of the MAR. Each agency may utilize their own MAR template; therefore, the location of each component may slightly vary.

Patient: Michael Daniels	
Date of Birth: 04/08/1982	
Allergies: NKDA	
Provider: Sarah Baker, MD	

Date: 02/10/2023													
Medication/Route	**Time**												
	0700	**0800**	**0900**	**1000**	**1100**	**1200**	**1300**	**1400**	**1500**	**1600**	**1700**	**1800**	**1900**
Furosemide (Lasix) 40mg PO Q Day			RR										
Metoprolol Tartrate (Lopressor) 50 mg PO BID			RR										
Metformin (Glucophage) 1000mg PO BID			RR										
Amoxicillin (Amoxil) 500mg IV TID		RR								RR			
Hydrocodone/ acetaminophen (Norco) 5mg/325mg PO Q 4–6 hours for moderate to severe pain						RR							
Amitiza 24 mcg PO BID as needed for opioid-induced constipation													

Initials	**Signature**
RR	Rabia Roman, RN

FIGURE 11.8 Example of documenting medication administration in the MAR. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

To document a medication administration, the nurse would place their initials in the box associated with the date and time of administration. Subsequently, the MAR indicates a place for the nurse to record their initials, print their name, and add their signature, so that initials may be correctly identified should the need arise. If a medication is to be administered more than one time per day, it is best practice to leave a couple of lines between the scheduled time rows to prevent the initials from running together. If the medication dose is ordered as a range, the dose may be indicated in the box closest in proximity to the nurse's initials. A line should be placed through any dates in which the medication should not be administered, for example, any dates that occurred prior to the medication order or after the medication was discontinued. Once the medication is discontinued, the nurse should ensure a line is placed through all subsequent dates, highlight the row yellow, and indicate if the medication order was changed or discontinued, along with providing the date and their initials.

In the event the dose is missed—perhaps the patient was not available during the scheduled time or the patient refused the medication—the nurse should place a circle around their initials in the box associated with the administration date and time, and then add a note to the back of the MAR to indicate why the medication was not

given. Evaluation of the medication, including patient's response to medication, PRN assessments, any other pertinent information should also be captured on the back of the MAR. Any follow-up assessments should also indicate the time frame in which the reassessment occurred.

Summary

11.1 Rights of Medication Administration

Nurses play a critical role in ensuring safe medication administration. Prior to medication administration, nurses must review medication orders to ensure accuracy, prevent transcription errors, and clarify any questions related to the medication order with the provider. During medication administration, ensuring the "rights" of medication administration are confirmed at three key checkpoints will reduce the potential for a medication error to occur. Following medication administration, nurses ensure patient safety by monitoring the patient for adverse reactions and reporting any unexpected reactions to the provider.

11.2 Dosing

Medication dosing typically utilizes three systems of measurement: the metric system, household system, and apothecary system. Of the three systems of measurement, the metric system provides the most accurate dose calculations. The nurse must be confident in their ability to calculate drug dosages to be able to verify and safely administer medications. Drug calculations may be performed using a variety of methods, including dimensional analysis, formula method, or ratio proportion method. Calculations may require consideration of additional factors, such as converting systems of measurement, weight-based dosing, and serum-based dosing. Utilizing the nursing process, the nurse may systematically calculate accurate drug dosages.

11.3 Documentation of Medication Administration

Nurses play a critical role in ensuring accurate and timely documentation of medication administration. It is important for the nurse to use only approved abbreviations, document medications immediately after they are administered, and evaluate medication effectiveness. Any errors in documentation should be corrected as soon as they are noted. Accurate documentation is also required for all actions taken by the nurse if a patient refuses a medication. Administration of any medication is documented in the MAR, which provides a comprehensive list of medications and serves as a communication tool for the interdisciplinary team. Ensuring the administration process is documented accurately and timely is essential in capturing that quality care was provided.

Key Terms

allergic reaction immune system response to a drug
anaphylaxis a rare, life-threatening reaction to a drug
apothecary system utilizes fractions as a part of the whole to measure weights and volumes
computerized provider order entry (CPOE) provider submits patient orders by electronic means
dimensional analysis factor-label method for solving dosage calculations
drug interaction when a drug reacts with another drug, food, supplement, or medical condition
electronic medication administration record (eMAR) electronic version of a MAR
formula method divides the desired amount by the amount on hand, then multiplies it by the quantity on hand to determine the dose
household system utilizes everyday household items, such as measuring cups and tablespoons, to serve as the measuring device
medication administration record (MAR) used to document medication administration
metric system decimal-based system based on units of 10
one-time order medication to be administered just one time
paradoxical effect effect of a drug is opposite from the intended effect
pharmacokinetics movement of drug molecules within the body based on how the drug is distributed, metabolized, absorbed, or excreted
PRN as needed
ratio comparison of one quantity to another, often described as a division problem
ratio proportion method sets the known ratio of drug amount to quantity equal to the desired amount to the unknown quantity
routine order medication order that is continuously followed until canceled
side effect undesirable effect related to a drug that is predictable
standing order standardized order that may be implemented under certain circumstances

STAT urgent, immediate action required
systems of measurement collections of measurement units and how they are associated with one another
tolerance a built-up resistance of the body to a medication
toxicity degree to which a drug can be poisonous or harmful to the body

Assessments

Review Questions

1. The nurse receives an order for acetaminophen (Tylenol) 350 mg every 4 hours. What action should the nurse take?
    a. administer the medication to the patient
    b. call the pharmacy to clarify the order
    c. call the provider to clarify the order
    d. assess if the patient has a headache

2. Before administering any medication, what is the nurse's priority action to ensure patient safety?
    a. verify the medication orders with another nurse
    b. assess if the patient has experienced any medication side effects
    c. verify patient identity using two identifiers
    d. document the medications given

3. During medication administration, how should the nurse confirm the medications are for the right patient?
    a. Ask the patient to state their full name and compare the name given to the name on the patient's armband.
    b. Ask the patient to state their full name and birth date, comparing the information to the medication administration record and the patient's armband.
    c. Ask the patient to state their full name and room number, comparing the information to the medication administration record and the patient's armband.
    d. Ask the patient to state their last name and birth date, comparing the information to the medication administration record and the patient's armband.

4. The patient is prescribed clopidogrel (Plavix) to prevent blood clots and is instructed not to drink grapefruit juice. These instructions are provided to prevent what potential adverse reactions?
    a. allergic reaction
    b. drug interaction
    c. paradoxical effect
    d. toxic effect

5. The five core "rights" of medication should be checked at three different checkpoints during the medication administration process. What are the three medication checkpoints?
    a. when obtaining, preparing, and documenting the medication
    b. when preparing, administering, and disposing of the medication
    c. when obtaining, preparing, and administering the medication
    d. when preparing, administering, and documenting the medication

6. Solve the following conversions:
    a. 2 tbsp = _____ mL
    b. 132 lb = _____ kg
    c. 3 oz = _____ mL
    d. 1 g = _____ mg

7. The nursing student is documenting administration of medications. What might the nursing student record to demonstrate an accurate understanding of how to properly document administration of medication?

a. administered omeprazole (Prilosec) 20 mg PO at 0740 AM
b. administered carvedilol (Coreg) 6.25mg PO @ 1902 PM
c. administered 1/2 tablet of lorazepam (Ativan) PO at 1235 PM PRN anxiety
d. administered 4 u of insulin aspart (Novolog) SQ at 739

8. When should documentation of medication administration occur?
   a. before the medication is administered
   b. while preparing the medication
   c. after the medication is administered
   d. before the end of the shift

9. If an error is made in the documentation of a medication administration, how should the nurse proceed?
   a. use Wite-Out to remove the error from the chart, initial and date the error
   b. use a permanent marker to mark through the error in the chart, initial and date the error
   c. squiggle over the error so it cannot be read, initial and date the error
   d. mark through the error with a single line, initial and date the error

10. The nurse is using a paper MAR to document medication administration. How should the nurse indicate a discontinued medication on the paper MAR?
    a. place a line through all subsequent dates; mark through the medication row with a permanent marker; write discontinued in the medication row
    b. place a line through all subsequent dates; highlight the row yellow; write discontinued, as well as the date and initials in the medication row
    c. place a line through the medication name; highlight the row yellow; write discontinued, the date, and initials in the medication row
    d. place a line through the medication name; mark through the medication row with a permanent marker; write discontinued, the date, and initials in the medication row

Check Your Understanding Questions

1. What are the required components of a complete medication order?
2. What are the eight rights of medication administration?
3. What three systems of measurement are commonly used for medication dosing? Which system of measurement is the most accurate?
4. Order: Ibuprofen (Advil) 400 mg PO Q4 PRN mild pain. Supplied: Ibuprofen (Advil) 200 mg tablets. How many tablets should the nurse administer?
5. Order: Potassium chloride 30 mEq PO × 1 dose. Supplied: 40 mEq/5 mL. How many milliliters should the nurse administer?
6. Order: Cefprozil (Cefzil) 15 mg/kg/day PO BID. Supplied: 125 mg/5 mL. Patient weight: 45 lb. How many milliliters should be administered per dose?
7. Why is it important for documentation of medication administration to be accurate?
8. What actions should the nurse take when a patient refuses a medication?

Reflection Questions

1. How has CPOE improved patient safety?
2. What questions might the nurse ask to gain a better understanding of the patient's drug allergies?
3. How has the BCMA improved patient safety?
4. Order: Alprazolam (Xanax) 0.5 mg PO TID. Supplied: Alprazolam (Xanax) 0.25 mg tablets. How can each step of the nursing process be applied to ensure safe dosing of the medication?

5. The nurse administers a PRN medication for nausea. Not until the end of the shift does the nurse remember to document the assessment of nausea and the evaluation of the medication. What should the nurse do?

What Should the Nurse Do?

Mrs. Smith, a 93-year-old female, was admitted with a hip fracture. The patient's medical history includes a recent fall, memory loss, and difficulty swallowing. The provider places the following medication orders:

- Tylenol 325 g PO Q4 hours
- Ibuprofen 800 mg PO Q6 hours PRN pain
- Tylenol 500 mg PO Q6 hours PRN pain
- Aspirin 81 mg PO

1. Are there any medication orders the nurse should question? If so, which ones?
2. What considerations should the nurse give when a medication is ordered on a scheduled and PRN basis?
3. Which medication should be administered if the patient complains of pain?
4. How might the patient's medical history potentially impact the administration of medications?

A new medication order is placed by the provider. Upon verifying the order, the nurse realizes the patient is allergic to the drug. The nurse calls the provider to inform them of the patient's allergy. The provider appears aggravated and tells the nurse to administer the medication anyway.

5. Which patient "right" is the nurse concerned about in this scenario?
6. How should the nurse respond to the provider?
7. What additional steps might the nurse take to ensure patient safety?

Order: Acyclovir (Zovirax) 1 g IV Q8 hours. Supplied: 500 mg/10 mL. Therapeutic range: 10–15 mg/kg IV Q8 hours. Patient weight: 187 lb.

8. How many kilograms does the patient weigh?
9. What is the Q8 hour therapeutic range (in milligrams) based on the patient's weight?
10. What is the Q8 hour therapeutic range (in grams) based on the patient's weight?
11. Is the prescribed dose within the therapeutic range?
12. How many milliliters should the patient receive per dose?
13. How many milliliters should the patient receive per day?

The nurse is caring for a patient who just had surgery. IV pain medication is administered in the morning prior to the patient working with a physical therapist. Somewhat later in the morning, the nurse administers the patient's first dose of enoxaparin (Lovenox) to reduce the risk of postoperative blood clots. Later in the day, the patient receives their first dose of Rocephin to prevent postoperative infection. Shortly after administering the Rocephin, the patient develops a rash and complains of itching. The following medications need to be documented in the patient's chart:

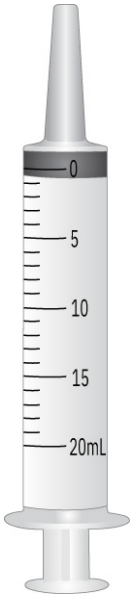
- 0845 AM—hydromorphone (Dilaudid) 1 mg IV
- 1003 AM—enoxaparin (Lovenox) 40 mg SQ left lower abdomen
- 1355 PM—ceftriazone (Rocephin) 1 g IV
- 1415 PM—diphenhydramine hydrochloride (Benadryl) 25 mg IV

14. What assessments are needed prior to administering these medications?
15. What evaluations are needed after administering these medications?
16. How long after administration should the nurse perform these evaluations?
17. How should the nurse document these evaluations?

Competency-Based Assessments

1. Develop an infographic that can be used to teach patients about their medication "rights."

2. Phenytoin (Dilantin) 0.5 g PO TID. Supplied: Phenytoin (Dilantin) 125 mg/ 5 mL. Indicate the number of milliliters the nurse should administer per dose on the syringe.



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3. Mr. Michael Daniels is a 40-year-old male patient of Dr. Sarah Baker. His date of birth is April 08, 1982. He has no known drug allergies. Dr. Baker places order on 02/10/2023 at 0734 AM for acetaminophen (Tylenol) 650 mg PO Q12h and insulin aspart (Novolog) sliding scale subcutaneous achs. Sliding scale: blood glucose less than 150, administer 0 units; blood glucose 151–200, administer 2 units; blood glucose 201–250, administer 4 units; blood glucose 251–300, administer 6 units; blood glucose 301–350, administer 8 units; blood glucose 351–400, administer 10 units. Blood sugar >400, call provider.

- Complete the MAR template according to the patient's orders.
- Document administration of 650 mg Tylenol at 1000 AM.
- Patient's blood sugar was 203 at 0755 AM. Document 0800 AM dose of Novolog.

Patient:	
Date of Birth:	
Allergies:	
Provider:	

	Date:												
Medication/Route	**Time**												
	0700	**0800**	**0900**	**1000**	**1100**	**1200**	**1300**	**1400**	**1500**	**1600**	**1700**	**1800**	**1900**

Initials	**Signature**

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4. Review the checklist for Calculating Medication Dosages and have a peer or instructor assess your performance of the task. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 12

Medication Administration Procedures

FIGURE 12.1 Medication administration requires competent and efficient nursing skills. (credit: "Set of different Drugs, pills, drugs and syringes on a white background" by "Marco"/Flickr, CC BY 2.0)

CHAPTER OUTLINE

12.1 Administering Oral Medications
12.2 Administering Parenteral Medications
12.3 Preparing Unit-Dose Packaged Medications
12.4 Administering Intradermal Injections
12.5 Administering Subcutaneous Injections
12.6 Administering Intramuscular Injections

INTRODUCTION Medication administration is a key function of the nurse. Nurses spend a large portion of their time administering medications. Therefore, the five "rights" of medication administration have been expanded to the eight "rights." Nurses have the responsibility for ensuring the right medication is properly prepared in the right dose and administered at the right time, via the right route, and to the right patient. The three additional medication administration "rights" are for the right reason, using the right documentation, and observing the right response (Lippincott Williams and Wilkins, 2024). As the final checkpoint in the medication process prior to administration, the nurse plays a critical role in ensuring patient safety.

Not only must the nurse administer the right dose of medication to the right patient, via the right route, at the right time, but the nurse must also ensure the appropriate medication administration procedures are in place. As such, the nurse must have demonstrated competency in administering medications via each individual route. Within this chapter, you will learn how to administer oral and parenteral medications. This chapter will explore the variety of routes in which these medications can be administered, common medication preparations for each route, necessary equipment for preparing and administering medications, special techniques for preparation, as well as the

appropriate procedures for administering medications via the different oral and parenteral routes. This knowledge will prepare you to be able to safely, and confidently, administer oral and parenteral medications.

12.1 Administering Oral Medications

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Explain the difference in various routes of oral medication
- Define various preparations of oral medications
- Demonstrate accurately the steps in medication administration

Medication administration routes refer to the way in which medications are given to the patient. The most common route of medication administration is the oral route (Ralston, 2018). Medications administered via the oral route may be supplied in a variety of forms. Depending on the drug and medication form, there are implications for practice that the nurse must be aware of and must follow. Following these implications are essential for nursing practice, because there are legal ramifications for not following the proper administration practices and techniques, including documenting the administration of medications. Within this section, we will explore aspects of proper administration for oral medications.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering Oral Medications

See the competency checklist for Administering Oral Medications. You can find the checklists on the Student resources tab of your book page on openstax.org.

Routes of Oral Medication

Administering medications via the oral route is simple and convenient. It is a widely acceptable route of administration that is the method by which most medications are administered in the home setting. Medications administered orally may begin in the mouth, enter the stomach, and usually end in the small intestine. While the oral route is the overarching umbrella, there are additional routes that fall under the oral umbrella, such as sublingual, buccal, and feeding tubes.

Oral

Medications ordered to be administered via the oral route (*per os*, or PO) are to be taken by mouth. After being swallowed, the medication is most often absorbed in the small intestine. Absorption of oral medications may be affected by factors such as the presence of gastric acid, food intake, absorption through the small bowel, and metabolism by liver enzymes (also known as first-pass drug metabolism) (Kim & De Jesus, 2023). Oral medications have a slow onset, typically about thirty to sixty minutes after administration.

Sublingual

Medications ordered to be administered via the **sublingual** route are placed under the tongue (Figure 12.2). These medications dissolve rapidly into the bloodstream for fast absorption and are not affected by first-pass drug metabolism, where the liver metabolizes or chemically alters the medication before it reaches the systemic circulation. Sublingual medications may be affected by eating, drinking, and smoking; therefore, they should not be swallowed, chewed, or taken with water. Due to the rapid absorption, medications administered via this route typically are used to treat emergencies, such as chest pain, allergies, or opioid dependence. Two medications commonly administered via the sublingual route are nitroglycerin (Nitrostat) and buprenorphine/naloxone (Suboxone). Suboxone, a combination medication used for long-term treatment of opioid dependence and opioid use disorder, is not to be confused with naloxone, an opioid antagonist used for the emergency treatment of opioid overdoses.

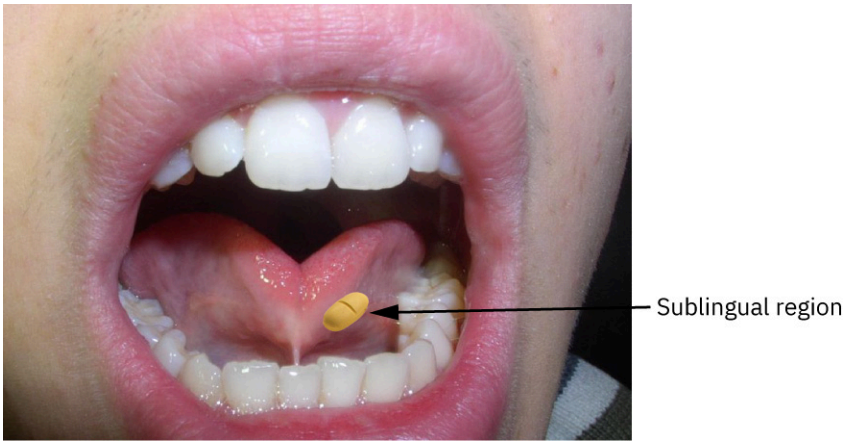


FIGURE 12.2 Sublingual medications are placed under the tongue for fast absorption. (credit: modification of "Latina: Frenulum linguae" by Klaus D. Peter, Wiehl, Germany/Wikimedia Commons, CC BY 3.0)

Buccal

Medications ordered to be administered via the **buccal** route are to be placed between the gum and the cheek (Figure 12.3). These medications dissolve rapidly into the bloodstream for fast absorption and are not affected by first-pass drug metabolism. Like sublingual medications, buccal medications may be affected by eating, drinking, and smoking; therefore, they should not be swallowed, chewed, or taken with water. Examples of medications that may be administered buccally include fentanyl (Sublimaze), naloxone (Narcan), and midazolam (Versed).

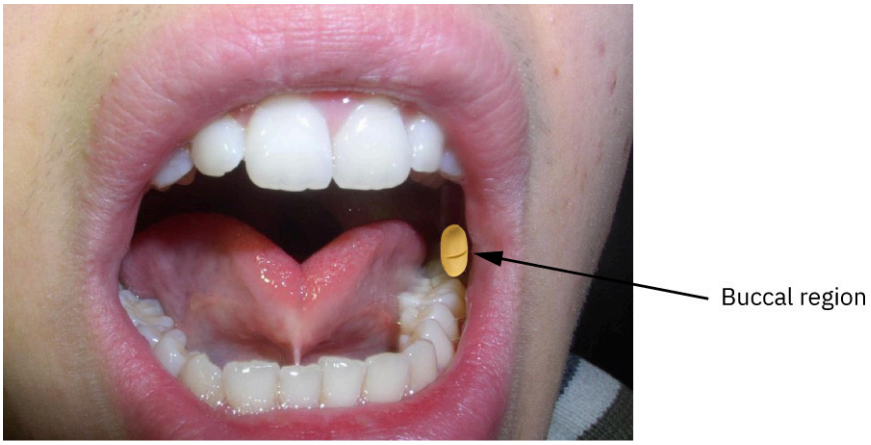


FIGURE 12.3 Buccal administration involves placing the medication between the gum and the cheek. (credit: modification of "Latina: Frenulum linguae" by Klaus D. Peter, Wiehl, Germany/Wikimedia Commons, CC BY 3.0)

Feeding Tubes

Some oral medications may also be administered via a feeding tube, such as a nasogastric tube (NG tube), gastrostomy tube (G tube), or jejunostomy tube (J tube). Not all oral medications are intended to be administered via a feeding tube; therefore, careful consideration should be given to the compatibility of the medication to be administered via the feeding tube route. Medications administered via a feeding tube need to be supplied in a liquid form, if available, or crushed and diluted if supplied in a solid form. To ensure safe practice of medication administration, it is recommended that an interdisciplinary team work together to form agency protocols for the medications administered via feeding tubes. It is also recommended that medications intended to be administered via a feeding tube be specifically ordered as such. The ordered route should state to administer the medication via the NG tube, G tube, or J tube, rather than PO.

Preparations of Oral Medication

Oral medications may be supplied in a variety of forms, such as solids, liquids, and suspensions. Within each form, there are several different preparation types, each with their own administration considerations. The nurse must be familiar with the various preparations and the techniques associated with each preparation to ensure that safe medication administration practices are followed.

Solids

Solid preparations of oral medications include powders, tablets, capsules, caplets, gelcaps, and lozenges. A **powder** is made of fine particles created from grinding a solid. A **tablet** is comprised of compressed powder or granules. An **enteric-coated tablet** is covered in a substance that delays the medication from dissolving. Enteric-coated tablets often are marked with an EC at the end of the medication name to alert the nurse to the type of medication. A **capsule** is powder or granules contained in a gelatin shell. A **time-released** capsule or tablet contains granules that slowly release for prolonged action of the medication. Time-released capsules typically have the abbreviations CR (controlled release), SR (sustained release), or ER or XR (extended release). A **caplet** is a solid, compressed powder or granules that are sometimes coated to make it easier to swallow. A **gelcap** is a soft gelatin shell with a liquid drug inside. A **lozenge** is a medication in a candy base that is meant to dissolve in the mouth.

Solid medications usually come prepared in a blister pack or bottle (Figure 12.4). Blister packs typically come in single-use packaging, whereas bottles contain multiple doses of the medication (multidose packages). Medications that come prepared in a blister pack protect the pills from being handled until the medication is opened at the patient's bedside. Medications that come prepared in a bottle require handling and the medication must be placed in a paper or graduated plastic cup or oral syringe in the medication preparatory area before taking it to the patient's bedside.

(a) **(b)**

FIGURE 12.4 (a) Solid medications may be packaged in blister packs or (b) bottles. (credit a: "Pildora lighht.JPG" by "Victor byckttor"/Wikimedia Commons, Public Domain; credit b: "EFFEXOR XR®" by Thomas Wilson Pratt Slatin/Wikimedia Commons, Public Domain)

Liquids

Liquid preparations of oral medications include syrups, elixirs, and emulsions. A **syrup** is a liquid form of a medication that contains added sugars and flavors. An **elixir** is a liquid form of a medication that contains added sugars, flavors, and alcohol. An **emulsion** is a solution that contains a medication, water, and oil mixture. Emulsions should not be administered to patients experiencing difficulty swallowing because of the risk of aspiration. When administering liquid medications, it is important to shake the medication well before measuring the dose.

Suspensions

A **suspension** requires undissolved drug particles to be mixed with a liquid agent before administration. It is important to shake the suspension well before administering the medication. Typically, liquid and suspension medications are prepared using an oral syringe, dosing cup, medication dropper, or medication spoon (Figure 12.5). Household spoons, such as flatware, are not recommended for measuring medications because they are not uniform in size.

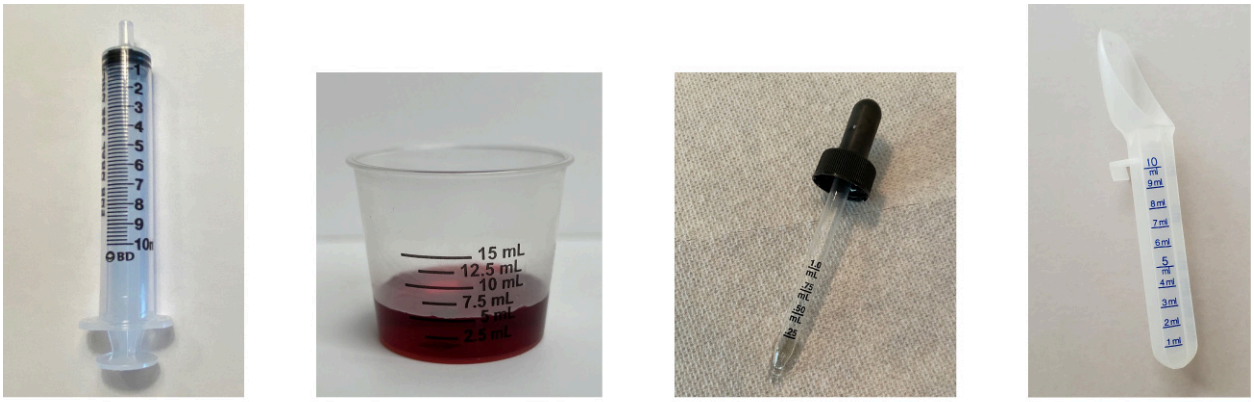


FIGURE 12.5 (a) Common devices used to measure liquid and suspension medications include oral syringes, (b) dosing cups, (c) medicine droppers, and (d) dosing spoons. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Steps for Oral Medication Administration

When administering medications, patient safety is the top priority. Therefore, considerations must be given throughout the medication process to ensure practices are in place that promote safe medication administration. This includes confirming the medication "rights" when collecting, preparing, and administering medications.

Before administering oral medications, the nurse should assess for contraindications that would prohibit the patient from being able to receive the medication, such as dysphagia, NG tube with gastric suctioning, NPO (nothing passed orally) status, or the inability to sit upright. After determining that oral medications may be safely administered, the nurse should verify the medication administration record (MAR) against the prescribing provider's orders. The nurse should then remove the medications from the medication cabinet, drawer, or automated dispensing cabinet, confirming the medication rights for each medication. The medications should then be prepared, confirming the rights for each medication a second time.

After the medications have been prepared, the nurse is then ready to administer the medications. After confirming the rights for each medication for a third time, the nurse should assist the patient into an upright position (Figure 12.6). If the patient is unable to be placed in the upright position, a side-lying position may be used; however, the nurse should use caution to ensure the patient's ability to swallow in this position. When positioned, the nurse should offer the patient something to drink. Consideration should be given to ensure the liquid offered is not contraindicated with any of the medications the patient is taking, and that the oral intake is accounted for within the medication record. Ask the patient if they prefer to take all medications at once or if they prefer the medications to be placed in the cup one at a time. Remain with the patient to ensure all medications are swallowed before documenting the medication administration. Perform any required post-assessments (e.g., blood pressure checks or pain reassessments) and document the patient's response to the medication.

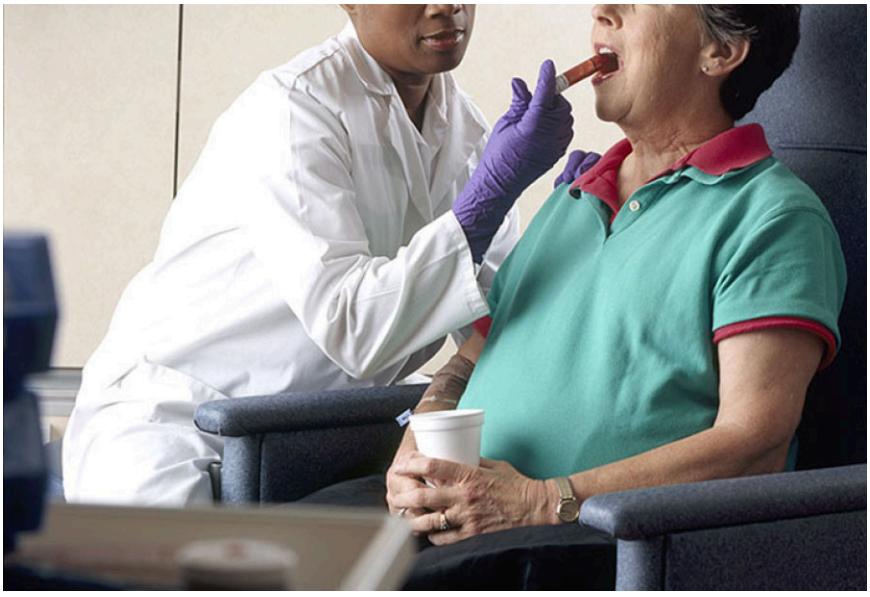


FIGURE 12.6 The patient should be positioned upright when administering oral medications. (credit: "Nurse Administers Oral Chemotherapy" by Rhoda Baer/Wikimedia Commons, Public Domain)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety: Oral Medication Administration

Disclaimer: Always follow the agency's policy for medication administration.

Definition: Reduce the risk of harm to patients through effective, efficient, and competent performance.

Knowledge: The nurse will analyze basic safety principles, understand evidence-based practice standards, and reflect on unsafe nursing practices (such as workarounds and dangerous abbreviations).

Skill: Demonstrate effective strategies to reduce the risk of harm. The nurse will:

- Avoid distractions and minimize disruptions when administering medications.
- Perform hand hygiene before handling and administering medications.
- Prepare medications for one patient at a time.
- Transport medications carefully in your hands, not in your pockets.
- Listen to the patient and explore any concerns they may express.
- If difficulties in swallowing are noted, do not administer medications until the concern is discussed with the prescribing provider.
- If the patient is NPO, clarify with the prescribing provider whether oral medications should be administered.
- If the patient has a feeding tube, clarify the intended route of medication administration with the prescribing provider, and ensure the order correctly identifies the feeding tube route.
- Dispose of unused medication according to agency policy. Controlled substances must be wasted. The waste must be witnessed by another nurse and documented by both nurses.

Attitude: The nurse will accept their individual role in preventing errors by adhering to safe, evidence-based practice standards.

Special Techniques

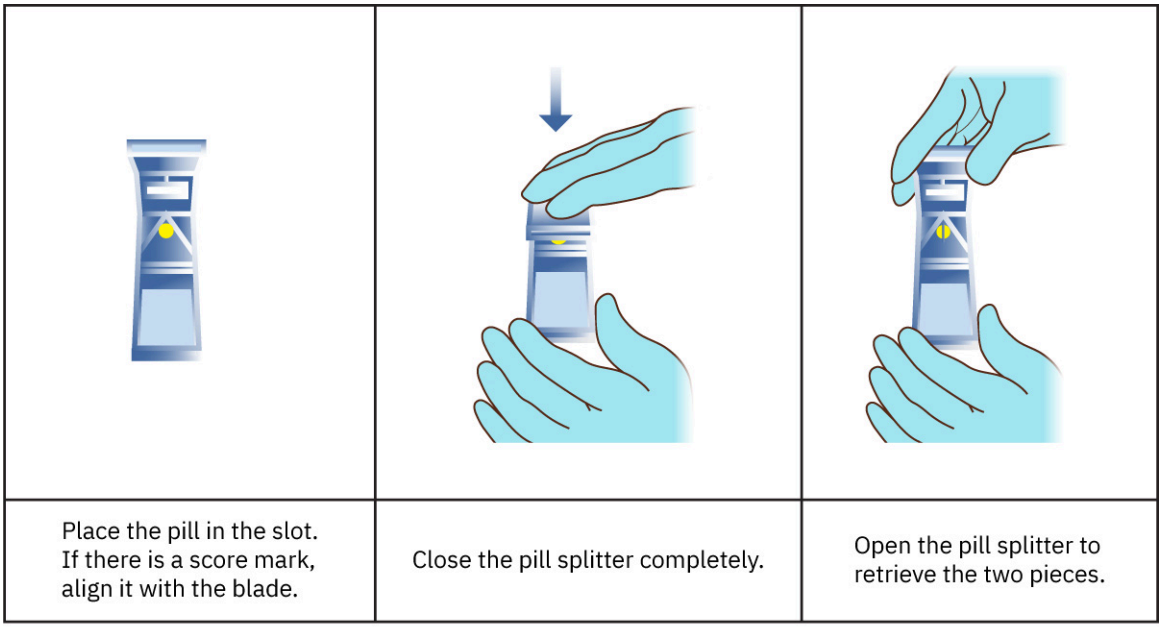
Several special techniques may need to be applied when administering oral medications. Although most oral medications are swallowed, there may be special instructions for the patient, such as "swish and spit" or gargling the medication. Some medications (e.g., magic mouthwash formulated to prevent or treat mouth sores) are ordered for the patient to swish the medication around in the mouth to coat as much surface area in the mouth as possible and then spit it out without swallowing the medication. Other medications, such as lidocaine, may be ordered as a gargle. The medication is moved around in the mouth and throat and then spit out without swallowing any of the

medication. Some medications, such as tetracycline, doxycycline, and chlorhexidine, are known to discolor or stain teeth. In these instances, the patient may be instructed to rinse their mouth or perform oral hygiene after swallowing the medication.

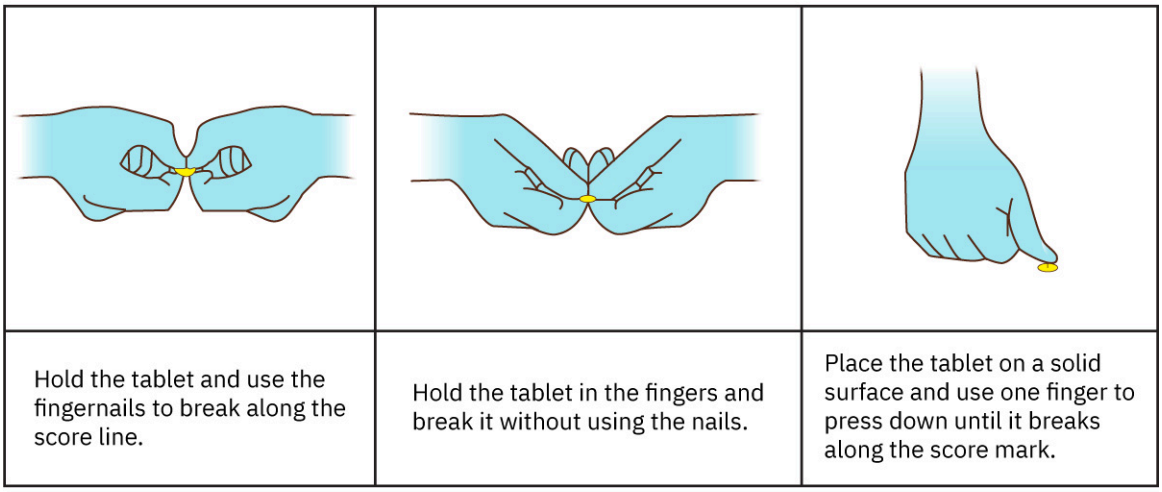
Sometimes a medication may need to be divided before being administered. Tablets that are scored (Figure 12.7) may be divided in half, thirds, or quarters, depending on how the tablet is scored. This technique may be used when the ordered dose is smaller than the supplied dose. For example, the prescribing provider may order enalapril maleate (Vasotec) 7.5 mg PO daily. The pharmacy supplies 5 mg tablets of enalapril maleate. After calculating the dose, the nurse determines that the patient should receive 1.5 tablets. Using the scored line, the nurse divides one tablet in half and disposes of the other half according to agency policy.

FIGURE 12.7 Scored tablet lines refer to the lines or grooves that are intentionally added to certain tablet medications during the manufacturing process. These lines create a breakable point, allowing the tablet to be easily and accurately divided into smaller doses, if needed. (credit a: "Drug Name: Azathioprine 50 mg oral tablet" by NLM/Wikimedia Commons, Public Domain; credit b: "Generic Levothyroxine" by NLM/Wikimedia Commons, Public Domain; attribution c: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

To properly divide the tablet, the nurse may use a pill splitter or break the tablet by hand (Figure 12.8). A pill splitter is preferred to ensure the most accurate splitting of the tablet. When using a pill splitter, align the scored marks on the tablet with the blade of the pill splitter and push down on the lid of the pill splitter. If a pill splitter is not available, tablets may be broken by hand by positioning the fingers on either side of the scored line and pressing down or by pressing down on the tablet on a solid surface. When breaking a tablet, it is important to ensure hand hygiene is performed and gloves are worn while handling the medication. Other forms of oral medications, such as capsules, caplets, and gelcaps are not scored; therefore, they cannot be divided.



(a)



(b)

FIGURE 12.8 (a) Pills must be properly divided. A nurse can use a pill splitter or (b) break the pill by hand. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

There may also be times when a medication needs to be crushed. For instance, if the patient is having difficulty swallowing, the medication needs to be crushed into a powder that can be dissolved in a liquid or administered via a feeding tube. Most tablets may be crushed; however, other forms of oral medications, such as capsules, caplets, and gelcaps cannot be crushed. Tablets that are designed to be controlled release (e.g., extended-release tablets) or that are coated (e.g., enteric-coated tablets) should never be crushed. Crushing medications that are not designed to be crushed may cause serious side effects, prevent the medication from working properly, or alter how the body processes the medication. Medications can be crushed using a pill crusher (Figure 12.9) and then mixed with applesauce, pudding, or another easily swallowed food or liquid. It is important to crush medications one pill at a time while at the patient's bedside after ensuring the "rights" of medication administration.

FIGURE 12.9 Pill crushers may be used to crush certain tablets. The pill crusher typically consists of a container or reservoir where the pill is placed and a grinding mechanism or crusher that helps crush the pill into a powder. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Administering oral medications to children requires special considerations. For instance, precise medication dosing is required for pediatric patients. Furthermore, children may be reluctant or unable to swallow medications. These and other factors require attention to detail and patience on the nurse's part.

LIFE-STAGE CONTEXT

Administering Oral Medications to Children

Several factors should be kept in mind when administering oral medications to children. Sometimes, children are reluctant to take medications. In these instances, it may be helpful to mix the medication with a soft food (e.g., applesauce) when possible or have the child's caregiver assist with administering the medication. Medications may need to be prescribed in a liquid or chewable form if the child is unable to swallow medications in a solid form. When administering liquid medications to a child, an oral syringe or medication dropper may be used to provide a precise measurement of the medication. Liquid medications should be squirted between the child's gum and cheek to avoid aspiration. It is important for the nurse to be patient when administering medications to children and to try to address the child's and caregiver's fears.

Nursing Roles and Responsibilities

When administering medications, one of the key responsibilities of the nurse is to assess the patient. Assessment is required before administering medications, during administration, as well as after administration. As previously noted, the nurse must assess the patient's current status, ability to swallow, and whether they are NPO before administering medications. Also, at times, vital signs should be assessed before administration. For example, heart rate and blood pressure should be assessed before administering cardiac medications. If the blood pressure or heart rate is low, then the medication may need to be held to prevent the vital signs from dropping even further. Laboratory results may also need to be reviewed. For example, if the patient's potassium level is high, administering more potassium likely will increase the potassium level even higher and can lead to toxicity. In addition, an assessment is needed before administering PRN (pro re nata, or as needed) medications. For example, the nurse should assess pain prior to administering pain medications and assess sleep patterns prior to administering a sleep aid. Should the nurse's clinical judgment warrant holding the medication, the prescribing provider must be notified.

During administration, the nurse should assess the patient's safety. This assessment should include confirming the patient's identity, checking allergies, reviewing the medication "rights," assessing the patient's ability to safely swallow medications, and identifying any sudden changes in the patient's condition. Should the patient begin to show signs of difficulty swallowing (i.e., coughing, choking, gurgling), the nurse should not administer any additional medications until the patient is further assessed and can safely swallow.

Post-administration, the nurse should assess the patient's response to medications. This assessment should include the patient's tolerance to the medications, whether the intended response occurred, re-assessing indications for PRN medications, as well as monitoring for adverse reactions. The post-administration assessment is important and may be used for clinical decision-making to determine next steps in the patient's care. For example, if the patient is still experiencing pain after receiving pain medications, perhaps a different medication may be warranted, or additional nonpharmacological strategies may be needed. If the patient experiences an adverse

reaction, the nurse may anticipate the medication to be discontinued and new orders may be required.

Other roles of the nurse include educating the patient and reporting medication errors. It is important to educate patients and their caregivers on the medications being administered, potential side effects, and special precautions that must be taken. Educating the patient on the correct process of medication administration helps the patient know what to expect and how to identify any discrepancies in the process. Should any medication errors, or potential errors occur, it is important for the nurse to report these errors according to the agency policy. Reporting medication errors encourages transparency, which allows for proper follow-up and identification of root causes. This is necessary for process and practice improvements to be made.

Nurses are legally responsible for ensuring safe and accurate administration of medications and may be held liable for medication errors. The nurse is also legally responsible for delegated tasks. Some states may allow the nurse to delegate medication administration to unlicensed assistive personnel (UAP) (Carder & O'Keeffe, 2016). In these instances, the nurse is responsible for supervising the UAP throughout the medication administration process. Although some tasks may be delegated to the UAP, the nurse remains responsible for the assessment, planning, teaching, evaluation, and nursing judgment associated with the administration of medications.

Delegation Considerations

When delegating medication administration to the UAP, the nurse must ensure the five rights of delegation: right task, right circumstance, right person, right directions and communication, and right supervision and evaluation. In determining the right task, it is important for the nurse to ensure the UAP has received the appropriate training and has been deemed competent in the skill. In determining the right circumstance, the nurse should consider the patient's circumstances before delegating the task. Instances in which the results are unpredictable, risks are involved, or medication administration challenges are predicted should not be delegated to the UAP. The right person involves delegating the right task for the right person. It is important for the nurse to be aware of which UAPs have been credentialed to administer medications and correctly identify the patient to receive the medication. In ensuring the right directions and communication, the nurse should provide clear instructions regarding the task that needs to be completed, when it should be completed, as well as any additional expectations associated with the task. The right supervision and evaluation requires the nurse to provide appropriate monitoring, evaluation, intervention, and feedback.

12.2 Administering Parenteral Medications

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the different parenteral routes of medication administration
- Identify safety guidelines for parenteral medication administration
- Recognize equipment used for parenteral medication administration

Parenteral medication administration refers to injecting medications directly into the tissues and circulatory system bypassing the skin, mucous membranes, and gastrointestinal tract. Administering medications via the parenteral route may be useful when the medication is poorly absorbed orally, when immediate onset or delayed onset is required, or if the patient is unable to tolerate oral administration of medications. Medications administered via this route are injected into the body; therefore, it is critical to ensure proper technique is followed at all times. Nurses must demonstrate competency before administering medications via this route because incorrect technique may cause physical harm to the patient and adversely affect medication absorption. This section will describe the various parenteral routes for medication administration and identify guidelines to prepare you to administer medications via this route safely, including the necessary equipment.

Types of Parenteral Routes

Medications administered via the **parenteral** route bypass the gastrointestinal system, eliminating the effects of first-pass metabolism. Compared to oral administration, medications administered via the parenteral route have a faster onset and provide stronger effects because they are not digested in the gastrointestinal tract. The parenteral route for medication administration is used when a rapid effect of the drug is required, a precise serum medication level is required, or when medications are poorly absorbed by the gastrointestinal route. Additionally, the parenteral route may be the best option for patients experiencing nausea and vomiting; those unable to tolerate oral fluids;

those unable to swallow; and those taking medications that are known to irritate the gastrointestinal system. Common routes of parenteral medication administration include intramuscular, subcutaneous, intravenous, and intradermal (Figure 12.10).

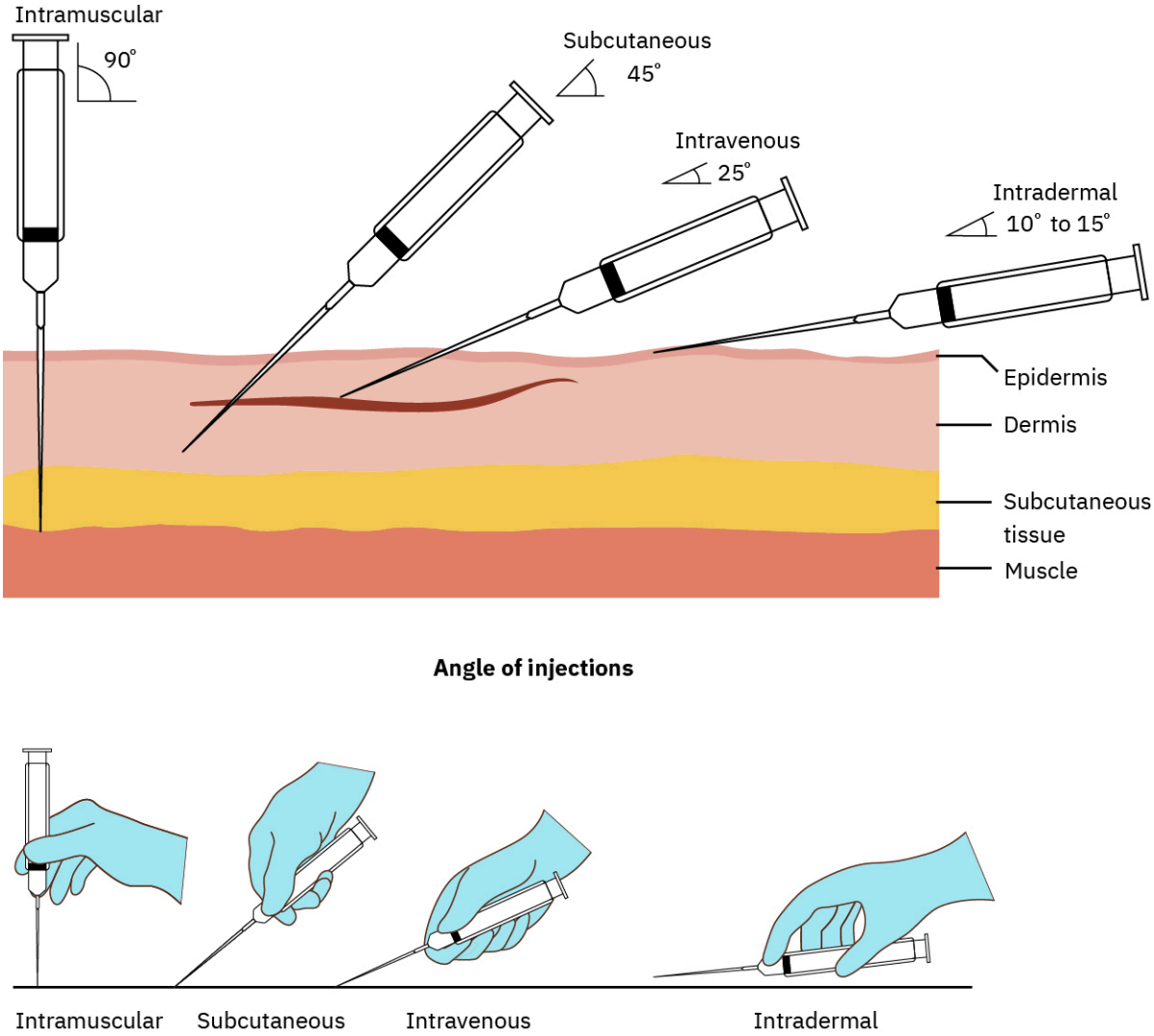


FIGURE 12.10 The type of parenteral administration determines the depth of the insertion and the angle of needle insertion. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Intramuscular

Medications administered via the **intramuscular (IM)** route are injected directly into a muscle. The intramuscular route is preferred to the subcutaneous route when larger volumes of medication need to be administered. The speed of absorption into the bloodstream depends on the blood supply to the muscle. Sites with more blood supply provide faster absorption. Examples of medications administered via the intramuscular route include antibiotics, biologicals, and hormonal agents.

Subcutaneous

The **subcutaneous (SQ)** route injects the medication into the adipose tissue, the loose connective tissue directly under the dermis. The medication is gradually distributed into the circulation system through the capillaries. Medications injected subcutaneously are absorbed slowly because fewer vessels are present in subcutaneous tissue. Examples of medications administered via the subcutaneous route include insulin, heparin, and epinephrine.

Intravenous

The **intravenous (IV)** route injects the medication directly into a vein through an IV line. These medications may be administered as a single dose or continuous infusion. Medications administered via this route are directly introduced into the bloodstream, which eliminates the need for first-pass metabolism. Medications administered via the IV

route have 100% bioavailability, the extent and rate at which a drug is absorbed and becomes available to the systemic circulation, and a rapid effect. As such, patients must be closely monitored to ensure the medication has the desired effect and to identify any undesired side effects. The effects of medications administered via this route tend to last a shorter time than other routes; therefore, some medications may need to be administered via a continuous infusion to maintain lasting effects.

The IV route is the preferred route to deliver a precise dose quickly or when the medication would be irritating to the body when administered via another parenteral route. If a patient already has an IV infusing, the nurse must ensure the medication to be administered is available in IV form and is compatible with other IV medications being given. Generally, healthcare providers attempt to use an already established route to administer a medication versus causing the patient unnecessary pain or discomfort. For example, administering a medication via an established IV causes less pain than administering additional IM or SQ injections. Examples of medications administered via the IV route include antibiotics, antihypertensives, opioids, and fluids. Intravenous medication administration will be further discussed in Chapter 13 Intravenous Administration.

Intradermal

When administering medications via the **intradermal (ID)** route, the medication is injected into the dermis, just below the epidermis. Medications administered via this route are absorbed slowly because of the limited blood supply found within the top layers of skin. Therefore, ID injections have very little systemic effect, making them ideal when a local effect is warranted. Examples of medications administered via the ID route include tuberculosis tests, local anesthetics, and allergy tests.

Other Parenteral Routes

Although intramuscular, subcutaneous, intravenous, and intradermal are the most common parenteral routes, there are additional parenteral routes. For example, parenteral medications may also be administered via the intra-arterial, intracardiac, intraperitoneal, intraosseous, and intrathecal routes. Each of these routes is unique, used under certain circumstances, and requires specialized training.

The intra-arterial route injects the medication into an artery rather than a vein. The carotid or vertebral arteries are the most common sites. Advantages of this route are that absorption is fast, within about fifteen to thirty seconds, and it allows for 100 percent bioavailability of the medication. This route may be used to inject contrast after an arterial puncture for angiography, to administer regional chemotherapy, as well as to treat malignant brain tumors. However, it is rarely used because of the high risk of patient injury during manipulation. As such, healthcare agencies must have strict protocols in place that are aligned with the state-specific Nurse Practice Act that dictate who, when, and how arterial lines are inserted, used, and maintained.

The intracardiac route injects medications directly into the myocardium or into one of the cardiac chambers. This route is fairly simple, easy to use, and inexpensive; however, it may not be an effective route for those with coronary stenosis or ischemic heart diseases. The primary indication for the intracardiac route is administration of resuscitative medications when other medication routes have failed during a cardiac arrest.

The intraperitoneal route injects medications into the lower left or right quadrants of the abdomen and into the peritoneal cavity. A benefit of this route is that the peritoneal cavity can absorb large amounts of medications quickly, while disadvantages include variability in effectiveness and potential for misinjection. This route is most commonly indicated for the treatment of peritoneal cancers.

The intraosseous route injects medications through a hollow-bore needle placed through the cortex of a bone into the medullary space. Intraosseous access is relatively fast and easy to obtain. Although this route can be extremely painful for the patient, it may be particularly useful in emergency situations, in neonates when peripheral and central venous accesses have not been successful, as well as for administering prophylactic antibiotics for regional surgeries.

The intrathecal route injects the medication into the subarachnoid space around the spinal cord. The intrathecal route is not to be confused with the epidural route, which injects medication into the epidural space and provides localized pain relief instead of the more profound effect achieved by the intrathecal route. After an anesthetic is injected, a needle is inserted into the lower spine between two vertebrae, where the medication is then injected in the subarachnoid space that is filled with cerebrospinal fluid. This route may be used with opioids for pain that

cannot be controlled via alternative routes, for hospice patients, and for chronic cancer-related pain.

Safety Guidelines for Parenteral Medication Administration

When administering medications via the parenteral route, safety is of the utmost importance. Medications administered parenterally are rapidly absorbed; therefore, there is an increased risk of overdose and rapid development of life-threatening adverse reactions. Furthermore, the speed of absorption may make it difficult to reverse the physiological effects of the drug. For this reason, it is critical to check the rights of medication administration before administering any medications to ensure the right dose, of the right medication, to the right patient, via the right route, and at the right time. This includes confirming the medication order; the patient's identity, allergies, and contraindications; medication calculations; necessary assessments; expiration dates; and safety precautions for high-alert medications, as well as questioning orders that do not seem correct.

The parenteral route requires the skin to be broken; therefore, the risk of infection is increased. To reduce the risk of infection, it is critical to abide by safe injection practices. For example, hand hygiene should always be performed before preparing medications, administering medications, and after removing gloves or touching the patient. Careful consideration must be given to ensure the needle is kept sterile. This includes ensuring the needle does not touch unsterile surfaces, such as the outside of the vial or counter, and ensuring the needle is covered when not in use. Care must also be given to avoid contaminating the length of the plunger and the Luer-lock, if using a two-piece needle and syringe, because contamination of these parts has the potential to introduce contaminants into the syringe (Figure 12.11).

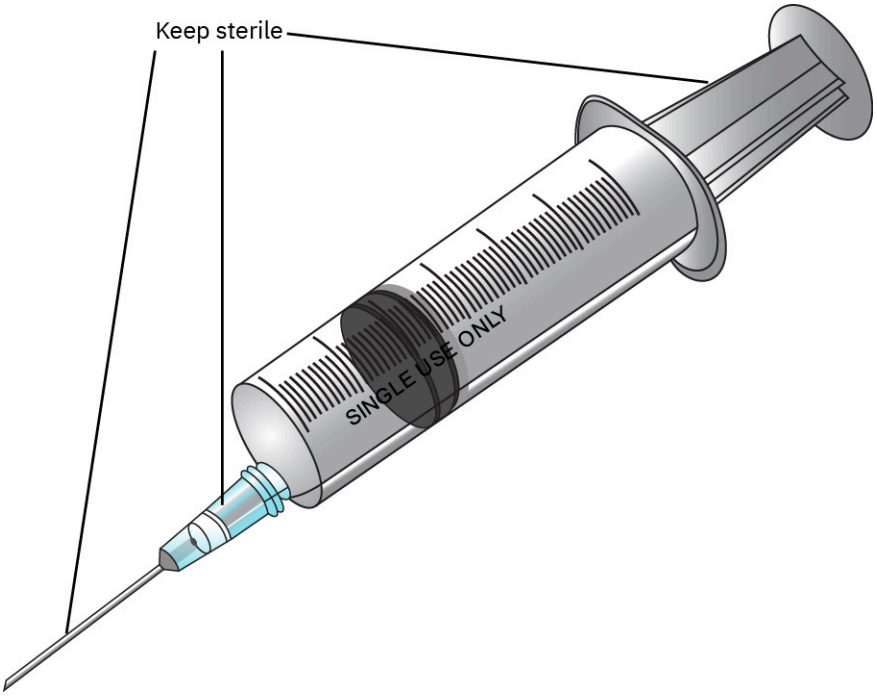


FIGURE 12.11 Maintaining the sterility of the syringe and needle is crucial to prevent contamination and ensure safe medical procedures. The needle, needle hub, tip of syringe barrel, and shaft of the plunger must remain sterile at all times. (credit: modification of "Needle syringe" by Togo picture gallery/Wikimedia Commons, CC BY 3.0)

It is also imperative to adequately prepare the patient's skin for the injection. Soap and water should be used when the skin is soiled, followed by cleansing the skin with an alcohol swab. To accurately cleanse the skin with an alcohol swab, use a circular motion to rub the area, from the center of the site outward in a 2 in (5 cm) radius, for fifteen seconds and then allow the area to dry for thirty seconds. Consideration should also be given to the location of the injection, the size of the needle, proper positioning of the patient, and insertion of the needle at an appropriate angle and depth.

Care should also be given to prevent needlestick injuries. When possible, needles should not be recapped. Alternatives to recapping may be to engage the safety device, change needles between preparing and administering the medication, or use a needleless system. The needle safety device should be engaged immediately after the

injection (Figure 12.12), using a hard surface to engage the safety instead of your finger. The needle should be disposed of in the sharps box. In the event of a needlestick injury, the injury should be reported immediately, and next steps should be determined according to the agency's policy. Strategies should then be identified to determine how the injury may be prevented in the future. To reduce the incidence of needlestick injuries, nurses should practice using the safety device on any new syringe being introduced to the facility. Every safety device is different and therefore requires familiarity before use on patients.

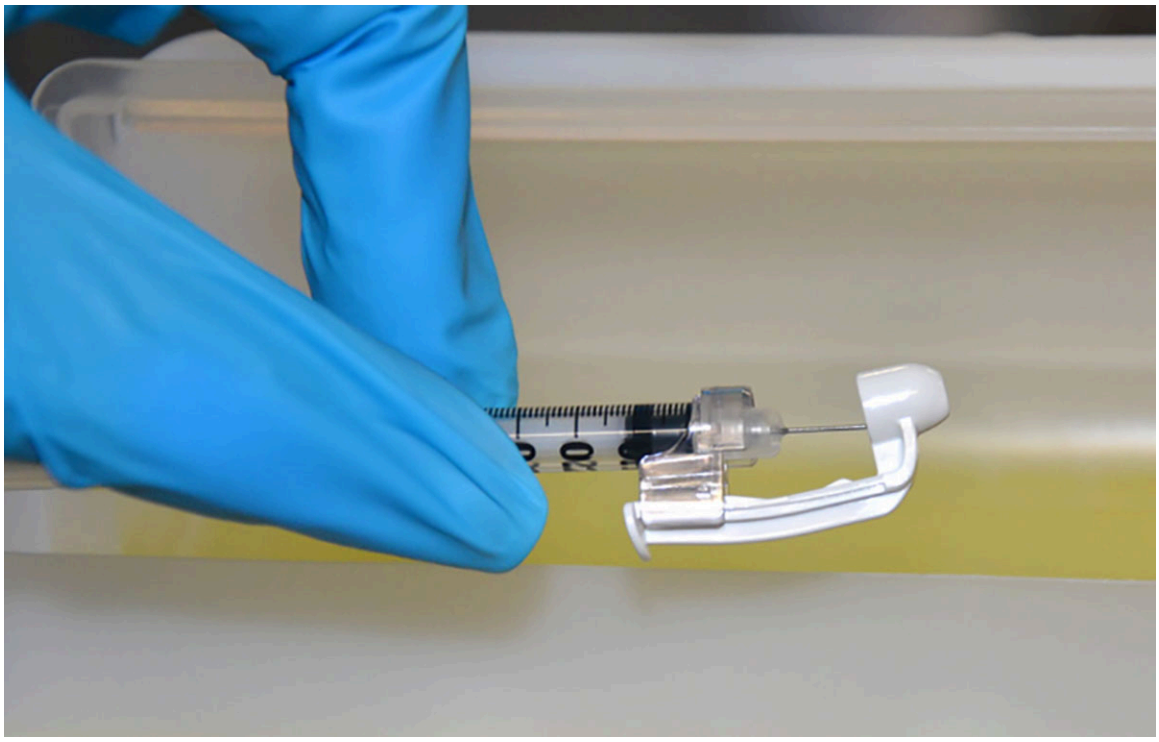


FIGURE 12.12 The nurse engages the needle safety device to prevent accidental needlestick injuries. (credit: modification of "Sept-22-2015-040.jpg" by British Columbia Institute of Technology, CC BY 4.0.)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety: Parenteral Medication Administration

Disclaimer: Always follow the agency's policy for medication administration.

Definition: Reduce the risk of harm to patients through effective, efficient, and competent performance.

Knowledge: The nurse will analyze basic safety principles, understand evidence-based practice standards, and reflect on unsafe nursing practices.

Skill: Demonstrate effective strategies to reduce the risk of harm. The nurse will:

- Avoid distractions and minimize disruptions when administering medications.
- Ensure all medication rights have been confirmed at least three times.
- Compare the medication order to the MAR.
- Check for allergies.
- Confirm medication calculations.
- Check expiration dates.
- Perform hand hygiene.
- Prevent needle/syringe contamination.
- Prevent medication solution contamination.
- Educate the patient.
- Clean the site.

- Use the correct needle size.
- Use correct administration rate.
- Prevent accidental needlesticks.
- Report all medication errors, adverse reactions, or near misses.

Attitude: The nurse will accept their individual role in preventing errors by adhering to safe, evidence-based practice standards.

Compatibility of Medications

When administering multiple parenteral medications at once, it is important to assess the compatibility of the medications. The **compatibility** of medications is the capability of administering two or more medications together without the two medications interacting with one another. When checking for compatibility of medications, you are checking to ensure there are no drug-drug interactions that would change the chemical makeup or effects of either drug. When medication incompatibilities occur, they can cause reduced effects of the medications or make them inactive, form harmful chemical reactions, increase toxicity of the medications, or create microparticles that are then injected into the body. To assess medication compatibility, the medications may be entered into an electronic drug interaction database or looked up in a drug reference guide. Often, organizations will provide a compatibility chart for quick access to commonly used medications. If in doubt, consult the pharmacy for further assistance.

Equipment Used for Parenteral Medication Administration

Equipment, such as syringes, needles, and needleless systems are required to administer medications via the parenteral route. Syringes and needles come in a variety of sizes. Selecting the most appropriate syringe and needle size depends on several factors, including the type of medication, location of injection, amount of medication required, and the size of the patient. As an alternative, needleless systems may be an option in some circumstances.

Syringes

A **syringe** is a sterile device that consists of a calibrated cylinder-shaped barrel with a sliding plunger at one end and an open tip that attaches to a needle or needleless system at the other end (Figure 12.13). Syringes come in a variety of sizes, ranging from 0.5 mL to 60 mL. The amount of the medication to be administered will determine the size of the syringe to use. Syringes come prepared as sterile devices from the manufacturer. After the package containing the syringe is opened, hold the syringe by the barrel to preserve sterility. Ensure that both the tip and the plunger remain sterile to prevent contamination.

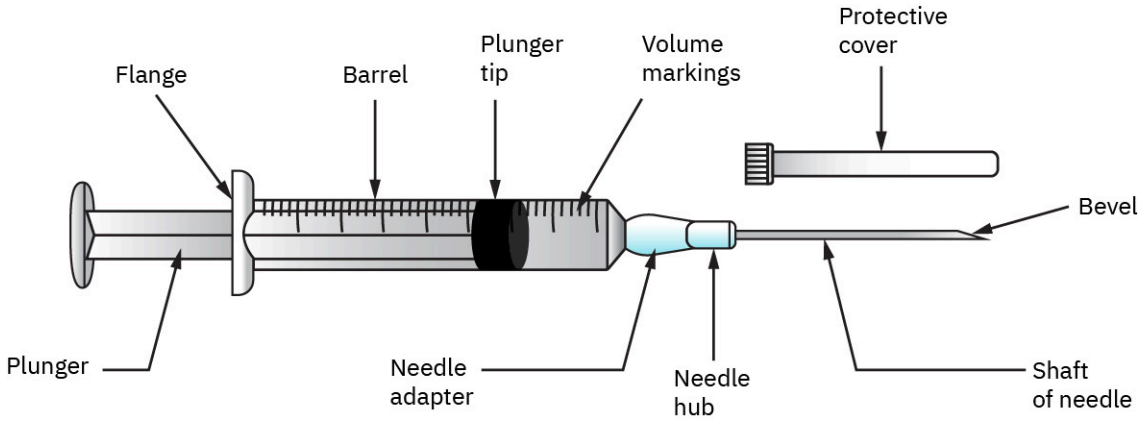


FIGURE 12.13 Syringes are used to administer parenteral medications. (credit: modification of "Labelled syringe" by Glynda Rees Doyle and Jodie Anita McCutcheon/British Columbia Institute of Technology, CC BY 4.0.)

Syringes may either be Luer-lock or Luer-slip (Figure 12.14). A Luer-lock connection allows the needle to be twisted on the tip of the syringe to lock the needle in place, whereas a Luer-slip, sometimes referred to as non-Luer-lock, connector fits the needle firmly on the tip of the syringe using friction but does not twist to lock it in place. Some syringes come packaged with a sterile needle, such as insulin and tuberculin syringes, with the needle built into the syringe. Other syringes may be packaged without a needle.

(a) (b)

FIGURE 12.14 (a) Syringes can be connected to a needle using one of two methods. A Luer-lock connection allows the needle to screw onto the syringe. (b) A Luer-slip connection allows a needle to remain in place using friction. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Needles

A **needle** is a hollow metal tube with a sharp and slanted point, called a **bevel**, and a hub that attaches the needle to the syringe (Figure 12.15). They are considered to be sterile and should remain sterile at all times. Needles come in various gauges and lengths. The needle gauge (G) measures the width or diameter of the needle. Typically, needles intended for parenteral medication administration range from 18G to 31G. The bigger the gauge, the smaller the needle. Needles also come in a variety of lengths, with typical lengths for parenteral injections ranging from 3/8 to 1.5 in (9.5 to 38 mm). Different-sized needles are used for different purposes.

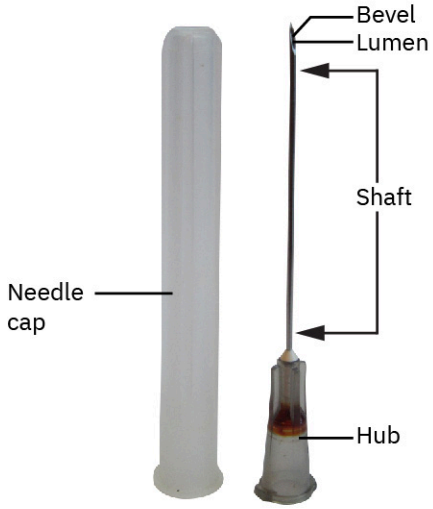
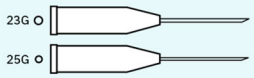
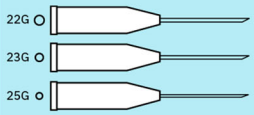
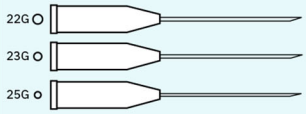
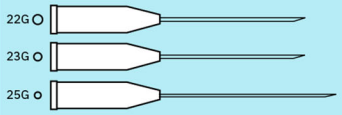
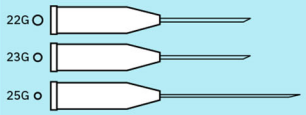
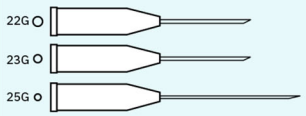
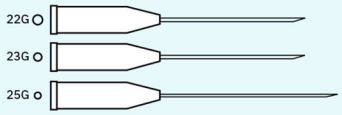
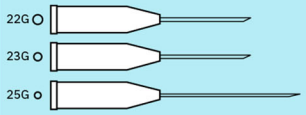
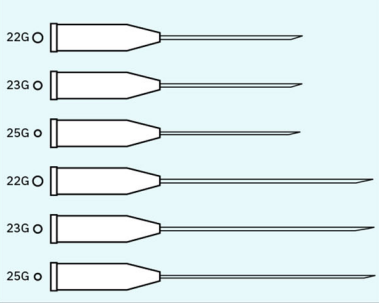


FIGURE 12.15 Needles are composed of a hub, needle shaft, lumen, bevel, and needle cap. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Determining Needle Size

Determining the correct needle size is important to ensure the appropriate delivery of the medication into the correct site. Furthermore, using the correct needle size also may reduce the risk of complications, such as pain, bruising, and abscesses. When selecting the correct needle size, the gauge and needle length need to be determined using a resource like a needle gauge chart (Figure 12.16). To determine the correct needle size, consideration should be given to factors such as injection site, the size of the patient, body composition, and the amount of medication being administered.

Route	Age	Needle gauge and length	Example	Injection site
Subcutaneous injection	**All ages**	23–25-gauge 5/8 in (16 mm)		Thigh for infants younger than 12 months of age[1]; upper outer triceps area for persons 12 months of age and older
Intramuscular injection	**Neonate, 28 days and younger**	22–25-gauge 5/8 in (16 mm[2])		Vastus lateralis muscle of anterolateral thigh
	Infants, 1–12 months	22–25-gauge 1 in (25 mm)		Vastus lateralis muscle of anterolateral thigh
	Toddlers, 1–2 years	22–25-gauge 1–1.25 in (25–32 mm)		Vastus lateralis muscle of anterolateral thigh[3]
		22–25-gauge 5/8[2]–1 in (16–25 mm)		Deltoid muscle of arm
	Children, 3–10 years	22–25-gauge 5/8[2]–1 in (16–25 mm)		Deltoid muscle of arm[3]
		22–25-gauge 1–1.25 in (25–32 mm)		Vastus lateralis muscle of antero-lateral thigh
	Children, 11–18 years	22–25-gauge 5/8[2]–1 in (16–25 mm)		Deltoid muscle of arm[3,5]
	Adults, 19 years and older 130 lbs (60 kg) or less 130–152 lbs (60–70 kg) Men, 152–260 lbs (70–118 kg) Women, 152–200 lbs (70–90 kg) Men, 260 lbs (118 kg) or more Women, 200 lbs (90 kg) or more	22–25-gauge 1 in (25 mm[4]) 1 in (25 mm) 1–1.5 in (25–38 mm) 1–1.5 in (25–38 mm) 1.5 in (38 mm) 1.5 in (38 mm)		Deltoid muscle of arm[3,5]

[1]May be administered into the upper outer triceps area if necessary
[2]If the skin is stretched tightly and subcutaneous tissues are not bunched
[3]Preferred site
[4]Some experts recommend a 5/8-inch needle for men and women weighing less than 60 kg. If used, skin must be stretched tightly and subcutaneous tissues must not be bunched.
[5]The vastus lateralis muscle in the anterolateral thigh can also be used. Most adolescents and adults will require a 1- to 1.5-inch (25–38 mm) needle to ensure intramuscular administration.

FIGURE 12.16 Needles come in a variety of gauges and lengths. Nurses are responsible for determining the correct needle length and gauge depending on the patient, medication, location and depth of injection required, and the viscosity of the medication. This chart is only an example of a resource a nurse might use, and the needle sizes in it are not necessarily to scale. (credit: modification of "You Call the Shots" by CDC, Public Domain)

The **gauge** of a needle is the diameter of the hole in the needle. When selecting the gauge of the needle, it is

important to consider the thickness of the skin and the depth of the injection. Larger-gauged needles have thicker needle walls; therefore, they are stronger and more suitable for intramuscular injections. Keep in mind that a larger gauge is a smaller number. On the other hand, smaller-gauged needles, or higher numbers, tend to create less pain and bruising for the patient and are most suitable for ID and SQ injections. Consideration should also be given to the viscosity of the fluid; higher-viscosity medications require lower-gauge needles. The most common needle gauge used for ID and SQ injections is 27G, whereas 25G needles are more commonly used for IM injections.

When selecting the length of the needle, it is important to consider the location of the injection. For example, longer needles may be used for IM injections, whereas shorter needles would be used for ID and SQ injections. The most common needle length for both ID and SQ injections is 0.5 in (13 mm), whereas 1 in (25 mm) and 1.25 in (32 mm) needles are commonly used for intramuscular injections. Patients who are very thin or exhibit cachexia, weakness, and wasting of the body as a result of severe chronic illness may require shorter needles based on assessment of the individual's anatomy.

Needleless Systems

A **needleless system** allows parenteral medications to be administered without the use of a needle. These systems alleviate the potential for needlestick injuries, cross contamination, and reuse of needles as well as reduce the pain experienced by the patient. There are needleless injectors (Figure 12.17), also known as jet injectors, which deliver a spring-powered injection that penetrates the skin without using a needle. Jet injectors may be used to administer medications via the subcutaneous or intramuscular routes.

FIGURE 12.17 A needleless injector, also known as a jet injector or needle-free injection system, is a medical device that delivers medication or vaccines through the skin using a high-pressure mechanism. (credit: modification of "Insulin Delivery Devices" by "BruceBlaus"/Wikimedia Commons, CC BY 4.0.)

Needle-free valves may be connected to IV catheters or administration sets to provide safe administration of IV medications. When used, the Luer-lock end of the needle-free valve may be cleansed with an agency-approved substance, and then a Luer-lock syringe may be twisted onto the valve. When the syringe or set is attached, a mechanism within the valve opens, allowing fluids to flow into or out of the IV line. When the syringe or set is removed, the valve automatically closes, helping to maintain the sterility of the IV system.

12.3 Preparing Unit-Dose Packaged Medications

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Discuss the guidelines for withdrawing medications from a vial
- Identify how to withdraw medications from a glass ampule
- Recognize how to use prefilled cartridges for medication administration
- Discuss the guidelines for safely reconstituting powdered medication
- Explain the guidelines for mixing medications in one syringe

Parenteral medications may be supplied in a variety of packages, such as vials, glass ampules, and prefilled cartridges. Sometimes, the medication will come prepared, ready for the nurse to administer. Other times, it may be necessary for the nurse to withdraw a dose of medication from a vial, add a liquid to a powdered medication to form a solution that may be suitable for the parenteral route, or mix multiple medications in the same syringe prior to administration. Each of these preparations requires specific guidelines to be followed when preparing the medication. This section will provide you with the knowledge needed to demonstrate appropriate preparation of unit-dosed medications for parenteral administration.

Withdrawing Medications from a Vial

Withdrawing medications from a vial is a common procedure for the nurse to perform. A **vial** is a glass or plastic container with a rubber stopper on top that contains a liquid medication (Figure 12.18). To prepare for the task, the nurse should gather the medication vial, syringe, needle (if not already packaged with the syringe), and an alcohol swab. Perform hand hygiene and ensure the work surface is clean. Examine the vial to verify the correct medication, concentration (if applicable), and the expiration date of the vial. If the vial is out of date, discard the vial according to the agency's policy and obtain a new vial.

FIGURE 12.18 A medication vial is a small container, usually made of glass or plastic, which is used to store and dispense medications in liquid or powder form. (credit: "Epinephrine-ampule" by "Jfoldmei"/Wikimedia Commons, CC BY 3.0)

To prepare the vial, remove the plastic cap from the vial if it is the first time the vial is being accessed. Use an alcohol swab to clean the rubber top. While the rubber top is drying, prepare the syringe. Remove the syringe and needle from the package, using caution to touch only the nonsterile surfaces. Attach the needle to the end of the syringe using aseptic technique. Once assembled, pull the plunger back to equal the amount of the medication to be administered, leaving the cap of the needle on during the process. Remove the cap, insert the needle in the center of the rubber top, and insert the air into the vial. Inserting air into the vial will reduce the vacuum effect and allow the medication to be removed from the vial more easily.

Invert the vial and needle, so the needle is pointing upward. Ensure the bevel is below the level of the solution. Pull back the plunger to obtain the correct dose. Remove any air bubbles by gently tapping the syringe. Gently press the plunger upward to expel the air bubbles from the syringe. If many bubbles are present, inject all of the medication back into the vial and slowly withdraw the medication again. Ensure all bubbles are removed and the correct dose is obtained, then invert the vial and syringe so the needle is pointing downward. Remove the needle from the vial and engage the needle safety device.

While recapping needles is generally discouraged because of the risk of needlestick injuries and potential exposure to bloodborne pathogens, there may be times when recapping the needle is necessary, such as if the needle is built into the syringe. If recapping is necessary, there are several guidelines to follow to minimize the risk of an accidental

needlestick injury:

- Use a one-handed technique: Keep one hand behind your back or at your side away from the needle during the recapping process.
- Maintain visual contact: Keep your eyes on the needle while recapping to ensure you can control the process.
- Use a scoop technique: Place the cap on the countertop. Hold the barrel of the syringe with your dominant hand and use a scooping motion to insert the needle into the cap. When the needle is covered by the cap, tip the needle and cap upward and use your nondominant hand to click the cap securely on the needle. Another option is to press the needle and cap on a hard surface such as wall to click the cap onto the needle. During the process, use aseptic technique to avoid contaminating the needle and exposed plunger.
- Use mechanical devices: If available, use mechanical devices designed for recapping needles safely. These devices often have mechanisms to hold and secure the needle cap without requiring direct manual contact.

LINK TO LEARNING

You can view how to withdraw medication from a vial (https://openstax.org/r/77medicationvial) in this video demonstration.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Withdrawing Medication from a Vial

See the competency checklist for Withdrawing Medication from a Vial. You can find the checklists on the Student resources tab of your book page on openstax.org.

Single-Dose Vials

Single-dose vials are approved to be used one time for one patient. They do not contain antimicrobial preservatives; hence, harmful bacteria may grow in the vial and infect the patient if it is reused. Therefore, it is important to discard the vial after every use, even if there is unused medication left in the vial after removing the required dose. Single-dose vials are preferred over multidose vials, when possible, to reduce the risk of contamination.

Single-dose vials may come in a variety of sizes; therefore, it is important to always check the medication label to determine if the vial is single-dose, rather than relying on the volume of the vial. If the vial says single-dose and it has already been accessed or the medication has expired, dispose of the vial according to the agency's policy and obtain a new vial. In general, the rule of "when in doubt, throw it out" is a good one to follow here.

Multidose Vials

Multidose vials contain more than one dose of medication. Vials are labeled for multiuse or single use. The manufacturer adds antimicrobial preservation to multidose vials. This helps prevent bacterial growth if safe injection practices are followed. This preservative, however, may not be effective against viruses. Multidose vials should be dedicated to a single patient, when possible. If the multidose vial enters the patient's room, it should be used only for that patient to prevent inadvertent contamination. Otherwise, the multidose vial should be kept in the medication preparation area at all times. New needles and syringes should be used for every injection, even if the multidose vial is used for only one patient. Do not leave needles in vials for subsequent medication withdrawals. If barcode administration is used, the pharmacy will usually supply a sheet of barcodes that may be applied to the syringe and later scanned in the patient's room, identifying the medication.

When using multidose vials, it is important to note the date when the vial was first accessed by placing a label on the vial with the date, time, and nurse's initials. This beyond-use date should be calculated according to the agency's policy, usually twenty-eight days unless the manufacturer specifies differently, and written on the vial. The beyond-use date should never extend past the manufacturer's expiration date. For expiration dates that display only the month and year, the unopened product is usable until the end of the month unless otherwise noted by the manufacturer. The vial should be discarded if sterility is compromised, the manufacturer's expiration date has passed, the vial is unlabeled with the date it was first accessed, the beyond-use date has passed, or the solution

appears abnormal (e.g., discoloration, floating particles, or cloudy when it should be clear).

Withdrawing Medications from a Glass Ampule

An **ampule** (Figure 12.19) is a small glass container that holds a single dose of a medication prepared in liquid form. Prior to opening the ampule, gently tap the ampule to move all of the liquid contents to the bottom of the ampule and wipe the scored line with an alcohol swab. To open the glass ampule, place a gauze around the neck of the ampule and snap the neck of the ampule off, at the scored line, away from your body. To withdraw the medication from the ampule, use a blunt fill needle with a filter to prevent glass particles from being drawn up into the syringe with the medication. Replace the filtered needle with a regular needle before administering the medication to the patient. After an ampule is opened, the contents must be used right away and not stored for later use.

FIGURE 12.19 A glass ampule holds a single dose of a liquid medication. (credit: "Urapidil 25mg-5ml vial yellow background" by "Wesalius"/Wikimedia Commons, CC BY 4.0)

LINK TO LEARNING

You can view how to withdraw medication from an ampule (https://openstax.org/r/77medicatampule) in this video demonstration.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Withdrawing Medication from a Glass Ampule

See the competency checklist for Withdrawing Medication from a Glass Ampule. You can find the checklists on the Student resources tab of your book page on openstax.org.

Special Considerations

When removing medications from an ampule, it is important to remember that the ampule is made of glass.

Therefore, precautions should be taken to avoid cutting yourself. As mentioned in the clinical procedures, it is important to wrap a gauze pad around the neck of the ampule to protect your hands from being cut by the breaking glass. In addition, the glass ampule should always be placed in the sharps container instead of a regular trash can. It is important to be aware of any glass shards that may result from opening the ampule and to ensure all glass is cleaned up properly. If the ampule breaks or does not result in a clean break around the scored line, causing shards of glass, do not use the medication. Carefully clean up, dispose of the glass, and obtain a new ampule. By following these protocols and using a filtered needle, the nurse may avoid drawing glass up into the syringe with the medication. Injecting glass into the patient may cause harmful side effects, including pulmonary thrombi, embolisms, phlebitis, granuloma formation, and inflammation.

Using Prefilled Cartridges

Some medications are packaged in prefilled cartridges. These prefilled cartridges may fall into two categories: injector devices or prefilled syringes. Prefilled cartridges have many benefits, including enhanced convenience, accuracy, sterility, and safety.

Prefilled cartridges come prepared with the medication premeasured and ready to use, which is much more convenient than having to draw up the medication from a vial or ampule. When a medication is already drawn up and ready to go, injections may be administered more quickly. Prefilled cartridges may be particularly helpful during emergent situations.

Prefilled cartridges may also enhance accuracy, because the manufacturer ensures the cartridges contain the correct amount of medication. It removes the potential for the individual to draw up the wrong amount of medication. This may be particularly helpful when patients need to self-administer the medication and have not been trained to calculate and measure doses.

Sterility is also enhanced when using prefilled cartridges. Prefilled cartridges have a shelf life of approximately two to three years, whereas medications that are drawn up from a vial or ampule typically have a shelf life of approximately twelve hours. Not to mention, there is less risk of contamination if the cartridge is prefilled and ready for the user to administer.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Preparing Medication Using a Prefilled Sterile Cartridge

See the competency checklist for Preparing Medication Using a Prefilled Sterile Cartridge. You can find the checklists on the Student resources tab of your book page on openstax.org.

Injector Devices

An **injector device** (Figure 12.20) is a spring-loaded syringe that delivers a single, preloaded dose of a drug when the device is firmly pressed against the body. These devices can deliver medications through subcutaneous or intramuscular routes. They are easy to self-administer, which may improve patient compliance and reduce anxiety. Some examples of injector devices include epinephrine injections (EPIPEN), insulin pens, diazepam (Valium) auto-injectors, and naloxone (Narcan) auto-injectors.

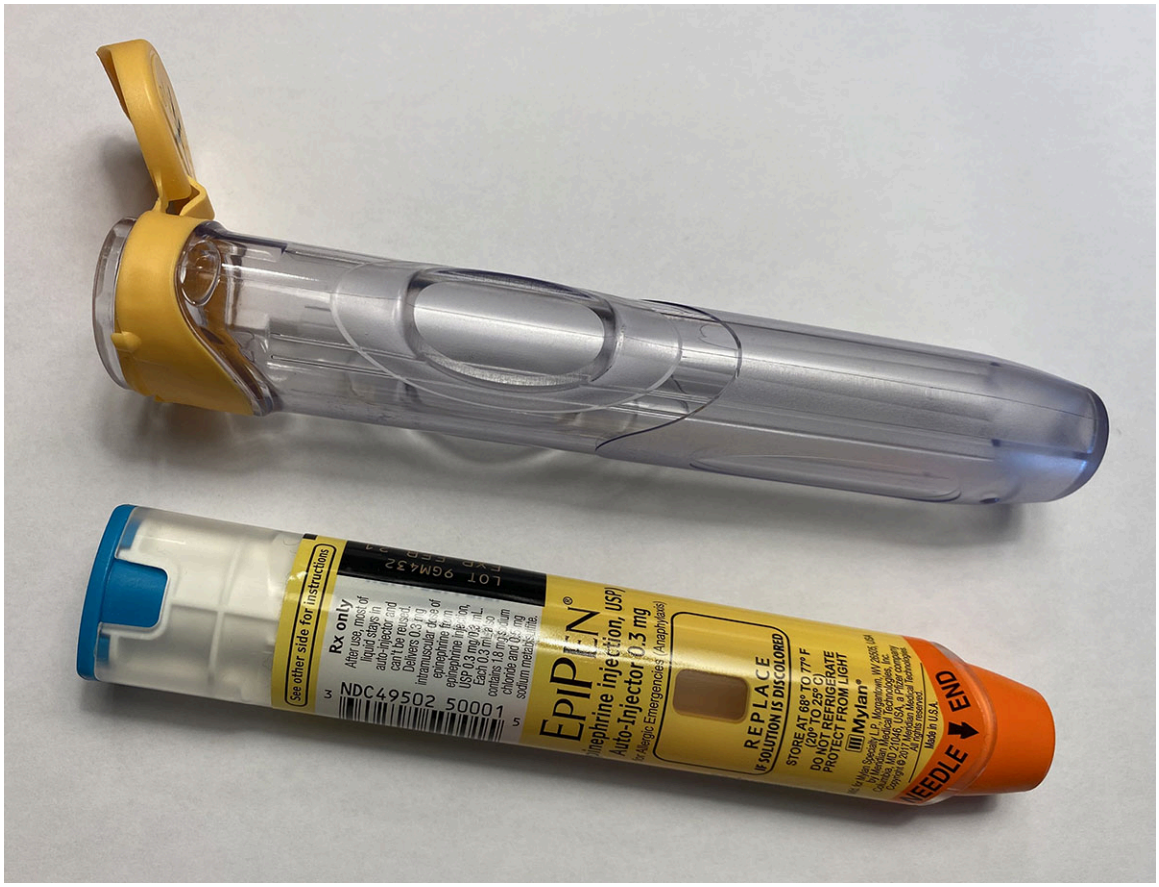


FIGURE 12.20 Injector devices are designed to facilitate the self-administration of medications by patients or caregivers. Auto-injectors provide a convenient and often less intimidating way to deliver injections compared to traditional syringes and needles. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Prefilled Syringes

A **prefilled syringe** (Figure 12.21) is a disposable syringe that is supplied with the necessary amount of the medication to be injected in a single dose. It is designed to simplify the process of medication administration by eliminating the need for healthcare professionals or patients to manually draw up the medication from a vial into a syringe before injection. By using a prefilled syringe, the risk of vial contamination or improper technique of preparing the medication is reduced, as well as reducing medication waste. In many cases, the prefilled syringe contains a Luer-lock that allows the needle to be twisted in place and then the medication is ready to administer immediately. If there is an air bubble present in the prefilled syringe, gently tap the syringe until the bubbles rise to the top of the syringe and slowly push the plunger up to expel the bubbles, using caution not to expel any of the medication. However, do not remove the air bubble found in enoxaparin (Lovenox) prefilled syringes, as this bubble is needed to help push the medication into the body. After administration, both the needle and the syringe must be discarded because reusing either component may transmit diseases. Some examples of medications that come in prefilled syringes include enoxaparin, propofol (Diprivan), fentanyl, hydromorphone (Dilaudid), and labetalol.

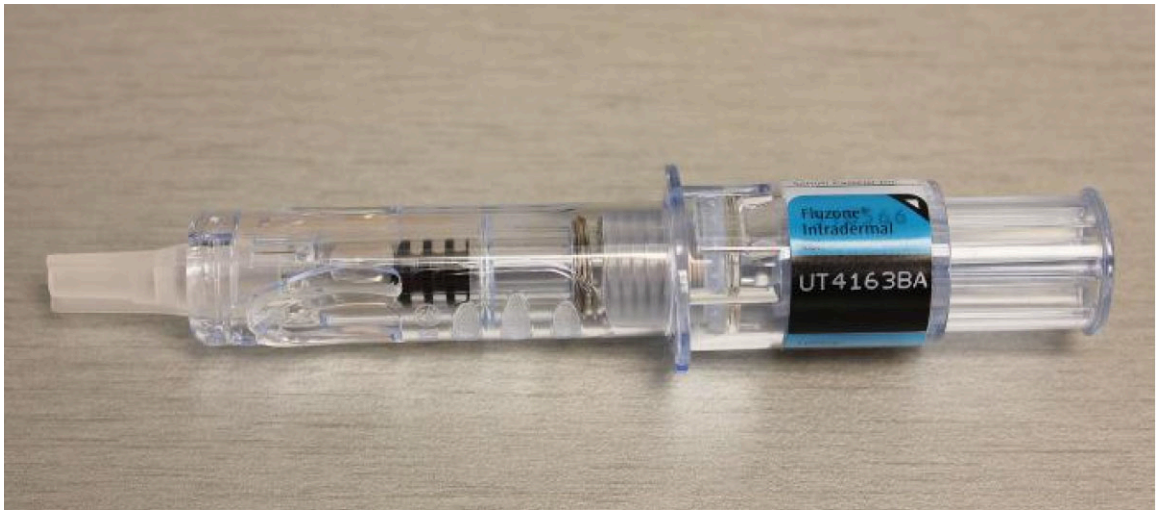


FIGURE 12.21 Prefilled syringes contain a single, premeasured dose of medication or vaccine in a ready-to-use form, which offers several benefits, including convenience, accuracy, and reduced risk of medication errors. (credit: Centers for Disease Control and Prevention/Public Health Image Library, Public Domain)

Prefilled syringes may also come packaged for use in a single-dose cartridge system, which loads a specific prefilled cartridge into a plastic holder for easy administration. This system reduces waste by reusing the plastic holder instead of requiring the medication to be withdrawn with a syringe and needle. When using the reusable plastic holder, it is important to wipe the holder down between uses with an appropriate antiseptic cleanser. If withdrawing medication from the single-dose cartridge system with a needle and syringe, do not inject air into the prefilled syringe because the pressure in the prefilled syringe will increase, forcing the rubber stopper and medication to be expelled from the prefilled syringe.

LINK TO LEARNING

You can view how to use the single-dose cartridge system (https://openstax.org/r/77singledose) in this video demonstration.

Guidelines for Reconstituting Powdered Medication

Some medications are unstable when supplied in a liquid form; therefore, they are packaged in a powdered form. Prior to administering these medications via the parenteral route, the nurse must **reconstitute** the powder (solute), or make it into liquid again, with a diluent (solvent) to create a liquid solution. It is important for the nurse to know how to properly reconstitute these medications to ensure that safe medication administration practices are followed.

Selection of Diluent

A **diluent** is the liquid used to dilute a powdered medication into a liquid form. Sterile solutions must be used when reconstituting parenteral medications. The type of diluent used varies according to the medication. Typically, parenteral medications are diluted with sterile water or sterile normal saline. The type and amount of diluent to be used should be identified in the medication package insert, in the medication label, or the electronic medication administration record (eMAR). If in doubt, consult the pharmacy or a medication reference guide to confirm.

Safety Considerations

When reconstituting powdered medications, it is important to locate the manufacturer's directions for reconstituting, typically found on the vial or package insert. Within the manufacturer's directions, there should be clear instructions regarding which diluent to use, as well as the volume of liquid needed to reconstitute the medication. The label should also identify proper storage for the medication after mixing, including the length of time the medication can be stored after reconstitution. To correctly calculate the dose, it is important to note the strength or concentration of the medication after it has been reconstituted. If in doubt or if any of the necessary information cannot be found, consult the pharmacy or a medication reference guide. Reconstitution instructions

must always be verified and never be assumed.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Selecting an Appropriate Diluent

The nurse is preparing to administer IV acyclovir to a patient. After retrieving the vial, the nurse notes that the medication is in a powdered form. Recognizing that the powdered medication must be turned into a solution before administering the medication via the IV route, the nurse analyzes the cues to determine whether the medication needs to be reconstituted. The nurse considers common diluents used for reconstituting medications and hypothesizes that sterile water or normal saline may be required; however, the nurse examines the medication label to determine which diluent to use. After reading the medication label, the nurse notes that the instructions read, "Inject 20 mL sterile water for injection into vial." The nurse takes action by reconstituting the powdered medication with 20 mL of sterile water.

After a medication has been reconstituted, it is best practice for the individual who prepared the medication to administer the medication. Should the individual preparing the medication not use the appropriate type or amount of diluent, the nurse who administered the medication may be held responsible should a medication error occur because of improper reconstitution. If the individual who prepared the medication is not the person administering the medication, best practice is to label the syringe with the type and amount of diluent used, as well as the expiration date of the diluent, and the time in which the medication must be used after being reconstituted.

Special consideration should be given to hazardous medications, such as chemotherapeutics or other cytotoxic drugs. When reconstituting hazardous medications, the procedure must take place inside a chemical fume hood or other containment device to provide safety in the event the powdered medication is released into the air. In addition to using a containment device, personal protective equipment (PPE) should also be worn to protect the individual preparing the medication from accidental exposure. Due to the required safety precautions, hazardous medications must always be reconstituted by trained professionals in the pharmacy.

Procedural Steps for Reconstituting Powdered Medication

Gather the necessary supplies: diluent, medication vial, needle, alcohol swab, and syringe large enough to hold the volume of the diluent. Check expiration dates on the diluent and medication vials. If expired, discard vials according to agency policy and obtain new vials. After performing hand hygiene, remove the plastic caps from the vials, clean the rubber stoppers with an alcohol swab, and allow the alcohol to dry. Then the nurse assembles the needle and syringe.

Inject air into the diluent vial, equivalent to the volume of diluent required. Invert the vial and needle so the needle is pointing up with the bevel below the level of solution inside the vial. Then withdraw the required amount of diluent and remove the syringe and needle from the vial. If there is more diluent in the vial than required, only remove the required volume, and dispose of the remaining diluent according to the agency's policy. Invert the vial and needle so the needle is facing upward, tap the syringe so air bubbles move to the top. Gently depress the plunger to remove all air bubbles. Inject the diluent into the medication vial. Gently roll the medication vial between your hands until the powder is dissolved, inspecting the vial to ensure all particles are dissolved. Invert the vial and needle so the needle is facing upward and withdraw the required amount of solution. If there is more solution in the vial than required, only remove the required volume, and dispose of the remaining solution according to the agency's policy. Invert the vial and needle so the needle is facing downward and remove the needle and syringe from the vial. Gently remove all air bubbles as described and engage the needle safety device.

LINK TO LEARNING

You can view how to reconstitute powdered medications (https://openstax.org/r/77reconstitute) in this video demonstration.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Reconstituting Powdered Medication

See the competency checklist for Reconstituting Powdered Medication. You can find the checklists on the Student resources tab of your book page on openstax.org.

Dual-Compartment Vial System

Some medications come prepared with the powdered medication and the diluent in the same package; however, they are separated in different compartments until they are ready for use (Figure 12.22). One example of a medication that comes prepared in a dual-compartment vial system is methylprednisolone sodium succinate (Solu-Medrol). To reconstitute the medication, simply press down on the plastic activator. This will displace the rubber stopper and allow the diluent into the lower compartment with the powdered medication. Gently swirl the vial (do not shake) to mix the solution. Ensure no particles are remaining before drawing up the medication. Remove the circular plastic covering on top of the plastic activator to reveal the rubber stopper and withdraw the medication according to the procedure for withdrawing medications from a vial.

FIGURE 12.22 Dual-compartment vial systems are designed to simplify the process of preparing and administering medications that come in powder form. These vials contain a premeasured amount of diluent (such as sterile water) that can be mixed with the powdered medication to create a solution suitable for injection. (credit: "Methylprednisolone vial" by "Intropin"/Wikimedia Commons, CC BY 3.0)

Guidelines for Mixing Medications in One Syringe

Some medications must be mixed from two vials or from a vial and an ampule. Other times, the nurse may mix medications to avoid the need for multiple injections. When mixing medications in one syringe, it is essential to first ensure compatibility of the medications. Consideration should also be given to ensure the volume of the mixed medications is appropriate for the injection site. Special consideration must be given when mixing insulins. It is important to follow the guidelines for mixing medications into one syringe to ensure patient safety, comply with

aseptic technique, and prevent contamination of the contents.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Mixing Medications from Two Vials in One Syringe

See the competency checklist for Mixing Medications from Two Vials in One Syringe. You can find the checklists on the Student resources tab of your book page on openstax.org.

Compatibility

It is important to ensure the medications are compatible before mixing medications into one syringe. Compatibility is the ability to administer two or more medications together without them interacting with one another. Incompatible medications drawn up or mixed together may alter the chemical makeup or effects of either medication. After being combined, the medications may have reduced effects or become inactive, harmful chemical reactions may occur, toxicity of the medications may be increased, or microparticles may be created and injected into the body. Compatibility of the medications must be assessed before administering the medications. To do so, the nurse may use an electronic medication interaction checker, look up the medications in a medication reference guide, or use a compatibility chart often provided by the organization (Figure 12.23) for quick access to commonly used medications. If uncertain about whether medications are compatible, consult a pharmacist.

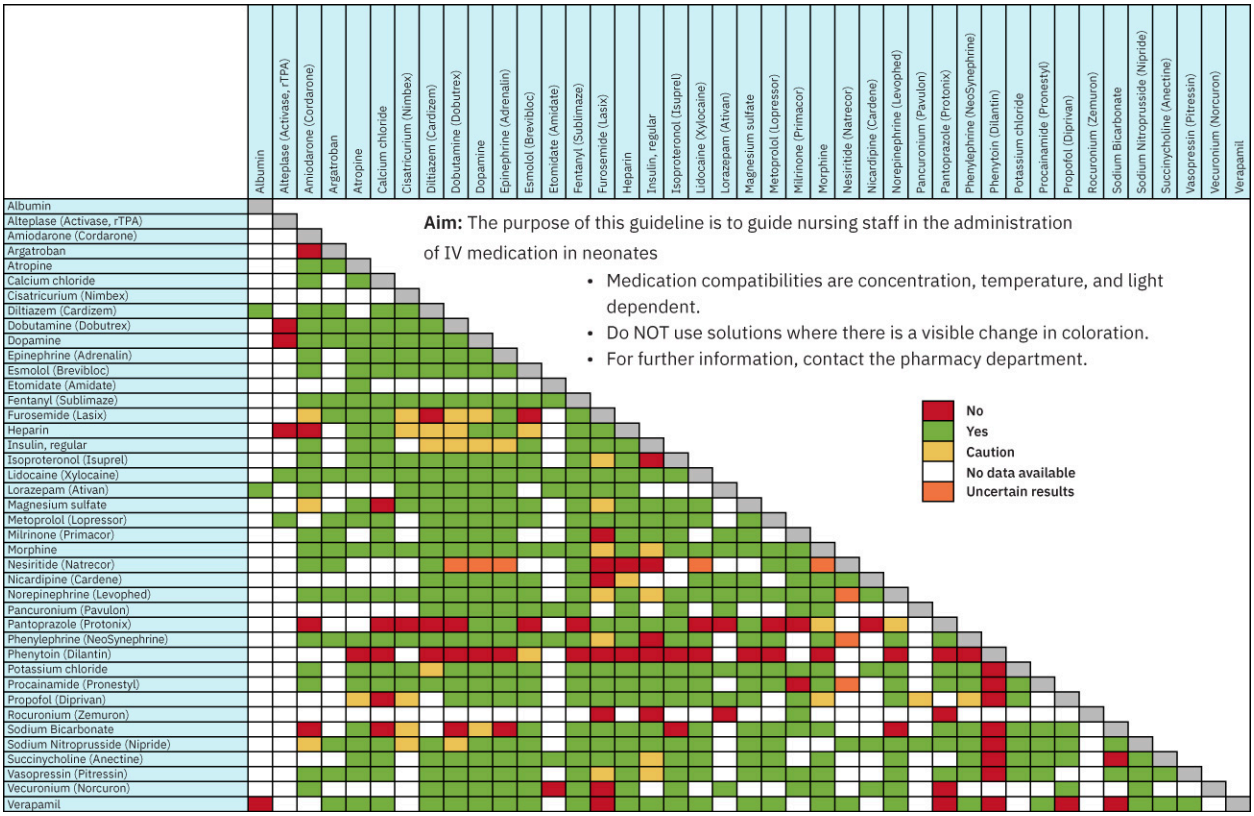


FIGURE 12.23 Medication compatibility charts are valuable references that provide information about the compatibility of different medications when combined. To determine compatibility, a nurse using a chart like this one would find the intersecting point between one medication on the *y*-axis and the other medication on the *x*-axis. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

REAL RN STORIES

Medication Compatibility

Nurse: Mike, RN

Clinical setting: Inpatient psychiatric unit
Years in practice: 5
Facility location: Southeastern United States

I was recently asked to float to an inpatient psychiatric unit. During the float assignment, a patient on the unit became very aggressive. My first action was to implement nonpharmacological and verbal de-escalation techniques but they were not effective. The prescribing provider had ordered diphenhydramine (Benadryl) 50 mg, haloperidol (Haldol) 5 mg, and lorazepam (Ativan) 2 mg IM times one dose. Reading the order, I understood that the three different medications were ordered via the IM route. I was concerned about giving all three medications at one time. After speaking with other professional personnel on the unit, I learned this combination of medications is widely used in the behavioral health setting and is known as a B-52 cocktail. So, I considered whether the medications could be combined into one syringe to avoid having to give the patient three injections. Therefore, I opened the electronic medication interaction checker, entered all three medications into the system, and concluded that all three medications were compatible. My next step was to calculate the total amount of the medications and ensure that the total volume did not exceed the maximum volume for an IM injection. Finally, I drew up the medications into one syringe and administered them to the patient in a single injection.

Volume Limits for Different Routes

When mixing medications into one syringe, it is important to consider the overall amount of fluid to be injected. This is particularly important when administering medications via the intradermal (ID), subcutaneous (SQ), and intramuscular (IM) routes. Injecting too much volume may be difficult for the body to absorb, cause increased pain for the patient, and result in adverse events at the injection site. The maximum volume for ID injections is 0.5 mL or less. Typically, the maximum volume for SQ injections is about 1.5 mL; however, volumes of 2 mL to 3 mL may be tolerated when injected into the abdomen. The maximum volume for IM injections is between 1 mL and 3 mL, though this can depend on the injection site. Children can withstand less volume via the IM route, with no more than 1 mL of fluid injected into the ventrogluteal muscles and no more than 3 mL injected into the vastus lateralis (1 mL in infants) (Table 12.1).

Route	Typical Maximum Volume
Intradermal	• Any site: Up to 0.5 mL
Subcutaneous	• Most sites: Up to 1.5 mL • Abdomen: Up to 3 mL

Intramuscular	• Adults:
	  ◦ Deltoid: Up to 1 mL
	  ◦ Ventrogluteal: 2 mL to 5 mL
	  ◦ Vastus lateralis: Up to 3 mL although 5 mL may sometimes be tolerated
	• Children:
	  ◦ Ventrogluteal: Up to 1 mL
	  ◦ Vastus lateralis: Up to 3 mL though 5 mL may be tolerated
	• Infants:
	  ◦ Vastus lateralis: 1 mL

TABLE 12.1 Parenteral Injection Volume Limits

Mixing Medications from Vial and Ampule

When mixing medications from a vial and an ampule, withdraw the medication from the vial first, followed by the ampule. Determine the amount of medication to be removed from the vial, the amount to be removed from the ampule, and the total volume that should be administered. Follow the guidelines for removing medication from a vial, remove the needle from the syringe using the scoop or hands-free method, add a filtered needle, and then proceed with removing the medication from the ampule. Use caution not to remove more than the exact required

dose from the ampule. Remove the filtered needle and replace it with an appropriate-sized needle according to the route of administration.

Mixing Insulins

Some insulins, such as intermediate-acting insulin and short- or rapid-acting insulins, may be mixed together in a single syringe so the individual will require only one injection. Mixing insulins is sometimes needed to help control an individual's blood sugar throughout the day, because the insulins have varying onsets. Insulin glargine (Lantus) and insulin detemir (Levemir) may never be mixed in the same syringe with each other or other insulins because doing so may alter the onset of the insulins, making it difficult to control the patient's blood sugar. It is important to follow proper sequencing for mixing insulins to prevent contaminating the insulin vials, which may adversely affect the onset of the medications.

Procedural Sequence for Mixing Insulins

When mixing insulins, obtain the two types of insulin, an insulin syringe large enough to hold the volume of both insulins combined, and alcohol swabs. To prepare the vials, gently roll the intermediate-acting insulin (cloudy vial) between your hands. Wipe the top of each insulin vial with an alcohol swab and allow the alcohol to dry. Inject air equal to the required units of the intermediate-acting insulin into the cloudy insulin vial. Remove the syringe and needle from the intermediate-acting vial. Inject air equal to the required units of short- or rapid-acting insulin into the clear vial of insulin. With the needle in the clear vial, invert the vial and syringe so the needle is pointed up. Ensure that the bevel of the needle is below the level of solution and slowly pull down on the plunger until the desired units of clear insulin are withdrawn into the syringe. Gently tap on the syringe to remove any air bubbles. If there is a large quantity of air bubbles, the insulin may be inserted back into the vial and the process repeated. Gently push up on the plunger to remove the air bubbles from the syringe. If any air bubbles are left in the syringe, the patient will receive less than the intended dose of insulin.

After the correct dose of clear insulin has been withdrawn and there are no air bubbles present, remove the needle from the clear insulin vial. Push the needle into the cloudy insulin vial and invert the bottle upside down with the needle pointed up. Slowly pull down the plunger until the total number of cloudy units are obtained (Figure 12.24). Be cautious that you have the correct number of units because the cloudy insulin has mixed with the clear insulin upon withdrawing the medication from the vial and cannot be pushed back into the vial. If too much cloudy insulin is withdrawn from the vial, discard the dose and start the procedure over.

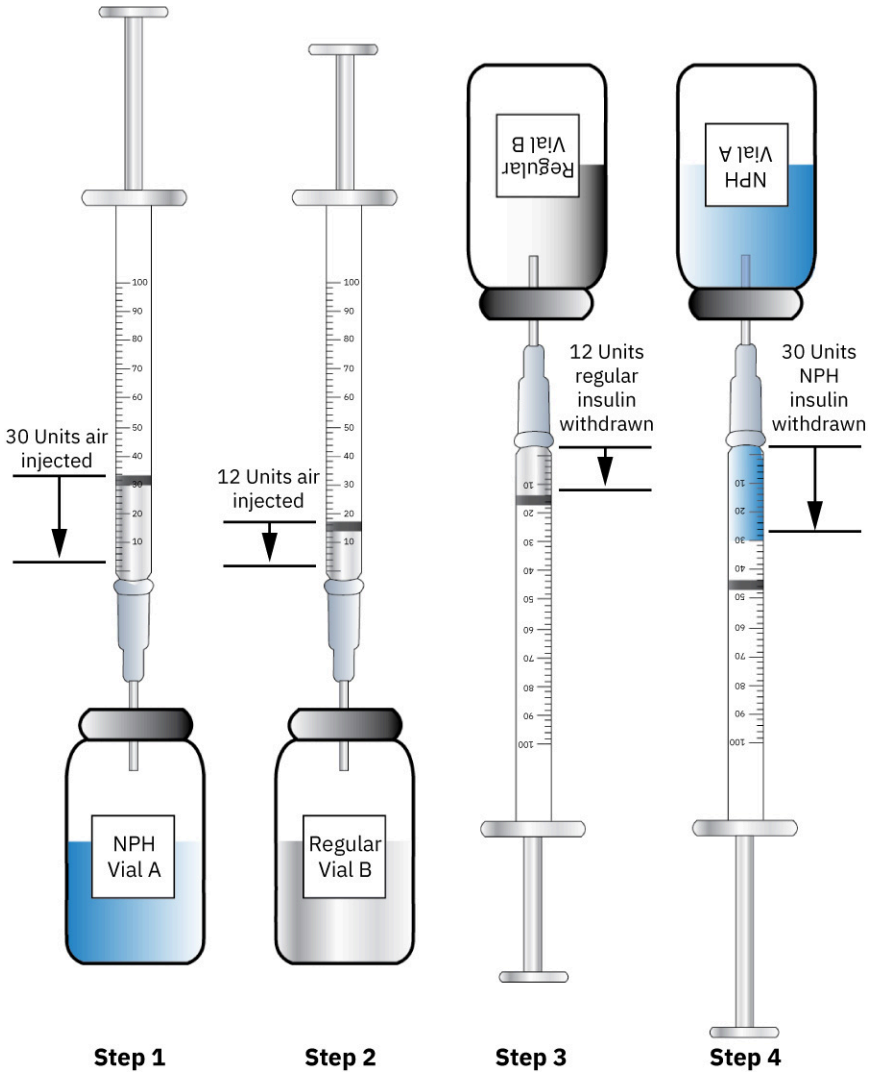


FIGURE 12.24 Mixing insulins involves combining two different types of insulin in a single syringe to achieve a customized dosage that meets a patient's specific needs using a specific sequence for mixing insulins. (credit: modification of "Mixing Insulin" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0.)

LINK TO LEARNING

You can view how to mix insulins (https://openstax.org/r/77mixinsulin) in this video demonstration.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Procedural Sequence for Mixing Insulins

See the competency checklist for Procedural Sequence for Mixing Insulins. You can find the checklists on the Student resources tab of your book page on openstax.org.

12.4 Administering Intradermal Injections

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the guidelines for using the intradermal (ID) route with medication administration
- Identify common medications administered via the ID route
- Perform steps for administering ID injections

Parenteral medications injected into the dermis are known as intradermal (ID) injections. Certain medications are indicated for this route because absorption via dermal tissue is slow. The nurse must be able to accurately perform the steps for administering ID injections, including selecting an appropriate injection site and needle size, and demonstrating proper technique. This section will provide you with the knowledge to safely administer medications via the ID route.

Guidelines for Using the ID Route

Medications administered via the ID route are injected into the dermis, just below the epidermis. Of all the parenteral routes, the ID route has the most prolonged absorption time. This is because there are fewer blood vessels and no muscle tissue available to distribute the medications. To ensure the medication is administered into the dermis, careful consideration must be given when selecting an appropriate anatomical site for the ID injection.

Anatomical Sites for ID Injections

When administering medications via the ID route, it is important to select an appropriate anatomical site. The most commonly used sites include the anterior surface of the forearm, posterior surface of the upper arm, the upper back and under the scapula, and upper chest (Figure 12.25). When selecting an injection site, the site should be free of lesions, rashes, moles, scars, sores, and veins.

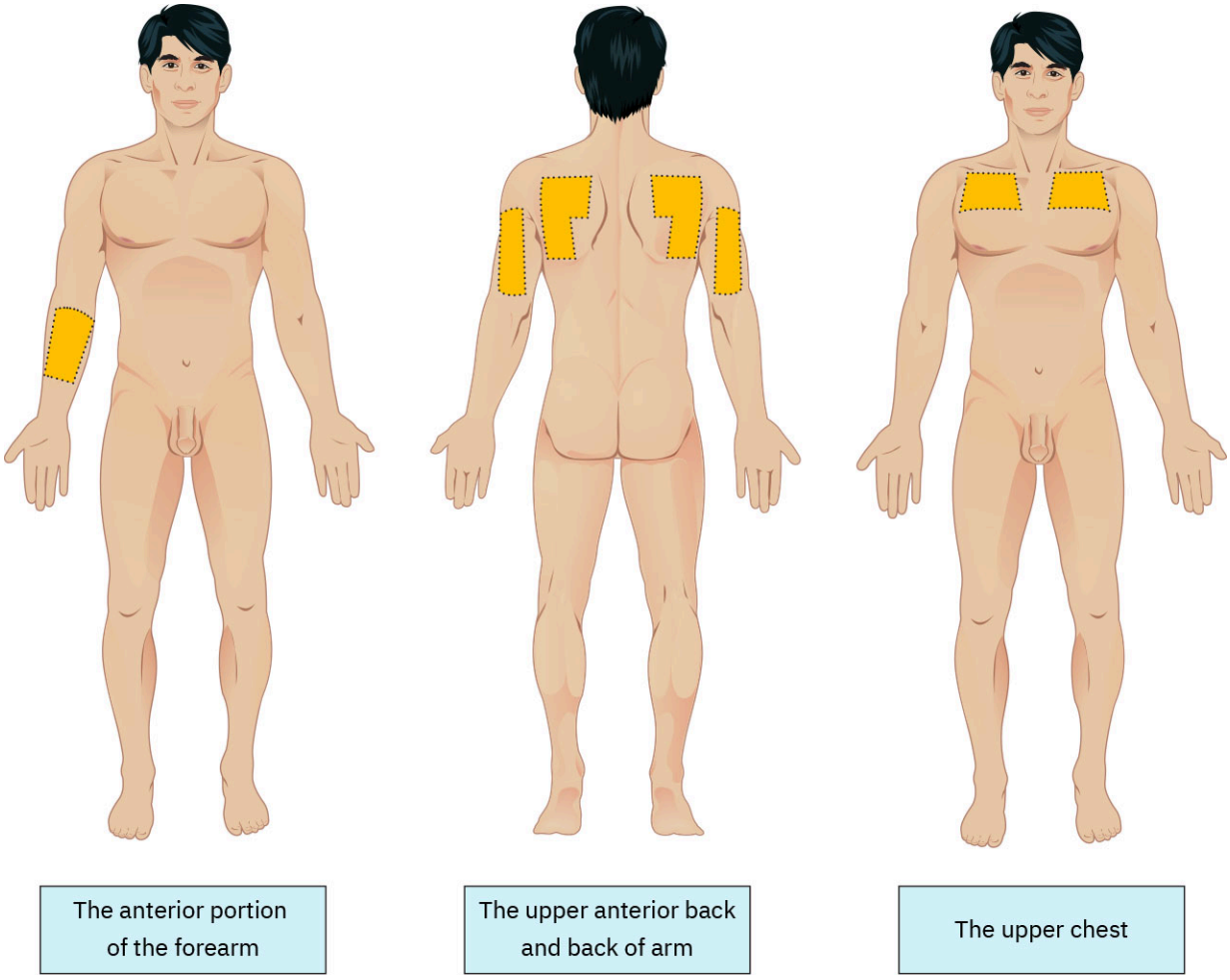


FIGURE 12.25 This illustration shows the anatomical sites appropriate for administering intradermal injections. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Common Medications Given Intradermally

Intradermal injections have a prolonged absorption rate; therefore, this route is not appropriate for all medications. The ID route is preferred when the patient's reaction to the medication needs to be observed, such as with Botox injections, allergy testing, or tuberculosis testing. It is also the preferred route for injecting steroids directly into lesions and when providing local anesthetics.

Botox Injections

Botulinum toxin (Botox) is commonly used for facial rejuvenation and anti-aging. Botox is typically injected into the forehead, between the eyebrows, and around the periorbital region. Typically, it is injected between 1 and 4 mm deep, depending on the injection site. When administering Botox, injections that are too superficial or too deep may lead to the drug being injected into the wrong muscle, which may cause undesired outcomes. Complications of Botox include mild bruising, brow or eyelid ptosis (drooping eyelid), dry skin, allergic reaction, injection site pain, headache, or unwanted cosmetic results. To reduce the risk of bruising, the nurse should ensure that makeup is removed, there is adequate lighting, and the skin is gently stretched to enhance visualization of the superficial blood vessels. Post-injection, patients should be instructed to apply ice and pressure to the injection site, avoid vigorous exercise, remain in the upright position for several hours post-injection, and avoid sleeping on their stomachs.

Allergy Testing

Intradermal allergy testing is used to determine if an individual is allergic to a particular allergen. To perform this skin test, the nurse injects a small amount of the allergen into the skin and then monitors the individual for a reaction at the site (Figure 12.26). The nurse marks the injection sites with a number to indicate which allergen was placed at each site. By doing so, the results of the test can be interpreted more easily and correctly. If the individual

is not allergic to the allergen, then no skin changes will be noted. If the individual is allergic to the allergen, a red, raised **wheal** will be present. In addition, the individual may experience itching, skin rash, stuffy nose, red watery eyes, or possible anaphylaxis. Therefore, it is critical to have an emergency kit nearby to treat potential allergies, such as epinephrine and antihistamine injections.

FIGURE 12.26 Allergy skin tests numerically identify the allergens tested. (credit: "Pricktest, 2020.jpg" by Axel Pettersson/Wikimedia Commons, CC BY 4.0)

REAL RN STORIES

Allergies or Anaphylaxis Reaction

Nurse: Rafael, RN
Clinical setting: Outpatient allergy clinic
Years in practice: 9
Facility location: Eastern United States

I work in an outpatient allergy clinic where we test patients for possible allergies by placing small quantities of different allergens intradermally. Most of our patients are referred to us because of a suspected allergy; therefore, we are always prepared to intervene if a reaction occurs during the allergy skin test.

One morning, I was performing the test on Ms. Sampson, a 54-year-old patient, who had a reaction to the test. I had placed several of the samples (grass, pollen, pet dander, mold) without any responses noted to the skin. I then proceeded to administer the food samples (milk, wheat, peanuts, eggs). Shortly after administering the food samples, Ms. Sampson started complaining of watery eyes and itching to the surface of the skin where the samples were placed. I assessed the patient's arm and noticed a raised wheel where the wheat test was placed. Per protocol, I had identified the sites where the samples were placed with corresponding numbers, so there was no doubt that the wheat had caused the reaction.

I grabbed the emergency kit just in case the patient went into anaphylaxis; however, thankfully, it was not needed. To help relieve the symptoms, I gave Ms. Sampson a 25 mg diphenhydramine (Benadryl) tablet, applied hydrocortisone cream to the test site, and placed a cool cloth on the site. I have seen my fair share of anaphylaxis reactions so I am always cautious about ensuring that the emergency kit is nearby.

TB Testing

The **Mantoux tuberculin skin test (TST)** is used to diagnose latent tuberculosis (TB). A small amount (0.1 mL) of purified protein derivative (PPD) is placed directly into the inner surface of the forearm, approximately 2 to 4 in (5 to 10 cm) below the elbow. When placed correctly, it should produce a visible elevation of the skin (also known as a wheal). The results of the test must be read within forty-eight to seventy-two hours of administering the test. If the test is not read within seventy-two hours, the test must be repeated. When assessing the results, measure the induration (firm swelling) of the wheal in millimeters, not erythema (redness). To assess the induration, visually inspect and gently palpate the test site. To measure the diameter of the induration, place the "0" of the ruler on the inside left edge of the induration and read the ruler on the inside right edge of the induration (Figure 12.27). Document the measurement of the induration, recording no induration as 0 mm. The results of the TST are interpreted using the diameter of the induration and the person's risk factors.

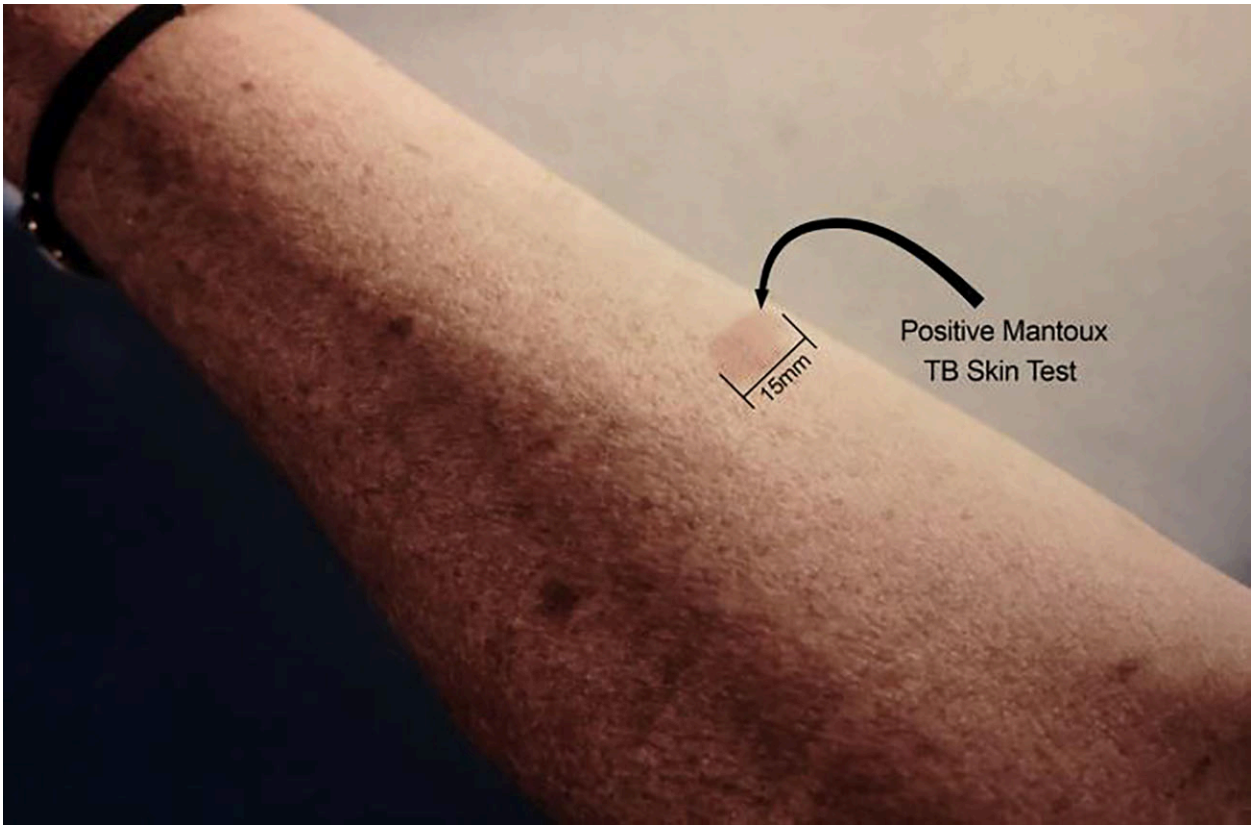


FIGURE 12.27 TB skin tests measure induration, not erythema. (credit: Centers for Disease Control and Prevention/Public Health Image Library, Public Domain)

Steroids

Steroids may be injected intradermally, directly into a skin lesion. Intralesional steroid injections are commonly used to treat skin diseases, such as keloids, alopecia areata, and circumscribed plaques of dermatitis. Triamcinolone acetonide (Kenalog), dexamethasone (Decadron), betamethasone (Betaderm), and methylprednisolone sodium succinate (Solu-Medrol) are the most commonly used intralesional steroids. Intralesional steroids should not be injected into active skin infections or if the patient has a known allergy to the medication. Potential side effects of intralesional steroids include pain, bleeding, bruising, infection, contact allergic dermatitis, impaired wound healing, abscess, lipoatrophy, and pigmentation changes.

Local Anesthesia

Local anesthetics (lidocaine [Xylocaine], bupivacaine [Marcaine]), may be administered intradermally to numb the skin prior to a procedure. Unlike general anesthetics, local anesthetics do not require a loss of consciousness. These medications work by blocking the signals at the nerve endings of the skin. Typical onset of action for lidocaine is usually one to three minutes, with a duration of thirty minutes to two hours. On the other hand, the typical onset of action for bupivacaine may be up to ten minutes but the duration may last up to three hours.

Steps for Administration of ID Injections

Safe administration of ID injections requires following proper technique. When administering ID injections, it is important to select an appropriate site for administration. After selecting the site, the nurse cleans the skin with an alcohol swab to help prevent pathogens from being introduced into the tissue by the needle. The nurse allows the skin to dry completely so that the alcohol is not introduced into the tissue. Holding the syringe at a 5- to 15-degree angle from the site with the bevel up allows for smooth introduction of the needle into the dermis (see Figure 12.10). The nurse inserts the needle about 0.25 in (6.4 mm) into the skin and slowly injects the medication. A small medication-filled bubble called a wheal or a "bleb" will appear at the injection site if administered correctly (Figure 12.28). Aspiration is not necessary because the dermis contains few blood vessels. After administration, the nurse removes the needle at the same angle in which it was introduced into the skin, engages the needle safety device, and discards the syringe in a sharps container. Do not massage the area after injection because this may spread the medication into the underlying subcutaneous tissue.

FIGURE 12.28 The presence of a wheal is often a visible sign of an underlying immune response or inflammatory reaction. (credit: Centers for Disease Control and Prevention/Public Health Image Library, Public Domain)

LINK TO LEARNING

You can view how to administer an intradermal medication (https://openstax.org/r/77intradermal) in this video demonstration.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering an Intradermal Injection

See the competency checklist for Administering an Intradermal Injection. You can find the checklists on the Student resources tab of your book page on openstax.org.

Needle Size and Syringe Type

Intradermal injections are administered using a tuberculin syringe (Figure 12.29). Tuberculin syringes are calibrated in tenths and hundredths of a millimeter, allowing for precise measurement. Depending on the manufacturer, this type of syringe may include a 26G or 27G needle that is 0.25 to 0.5 in (6.4 to 13 mm) in length.

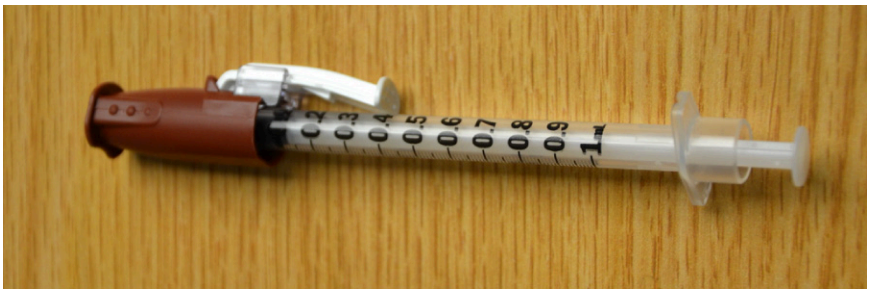


FIGURE 12.29 This photo shows a tuberculin syringe with a 26G or 27G needle and safety cap. (credit: modification of "Insulin syringe with safety shield" by Glynda Rees Doyle and Jodie Anita McCutcheon/British Columbia Institute of Technology, CC BY 4.0.)

12.5 Administering Subcutaneous Injections

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the guidelines for using the subcutaneous (SQ) route for medication administration
- Identify common medications administered using SQ injections
- Demonstrate the steps for correct administration of SQ injections

Parenteral medications injected into the adipose tissue between the skin and muscle are known as subcutaneous (SQ) injections. Certain medications are indicated for this route because absorption is slow within adipose tissue. The nurse must be able to accurately perform the steps for administration, including selecting an appropriate injection site and needle size, and using proper technique. This section will provide you with the knowledge to safely administer medications via the SQ route.

Guidelines for Using the SQ Route

Medications administered via the SQ route are injected beneath the skin into the adipose tissue, just below the epidermis and dermis. Medications administered via this route have a slow, sustained rate of absorption because there are fewer blood vessels present to distribute the medication. Physical exercise and the application of hot or cold compresses alters the blood flow to the tissues, which may alter the rate of medication absorption. Usually, no more than 1 mL of medication will be injected at any given time via the SQ route because larger amounts of medication may cause discomfort to the patient and may not be absorbed appropriately. To ensure that the medication is injected into the adipose tissue, careful consideration must be given when selecting an appropriate anatomical site for the SQ injection.

Anatomical Sites for SQ Injections

When administering medications via the SQ route, it is important to select an appropriate anatomical site. The most commonly used sites include the outer portion of the upper arm, the anterior thigh, the abdomen below the costal margin to the iliac crest no closer to the umbilicus than 1 in (2.5 cm), the upper ventral gluteal region, and the upper back. (Figure 12.30). The site selected should be free of skin lesions, rashes, and moles. Avoid sites that are bruised, tender, hard, swollen, or over bony prominences. When administering SQ injections, the site should be rotated to prevent **lipoatrophy** or the formation of **lipohypertrophy** of the skin.

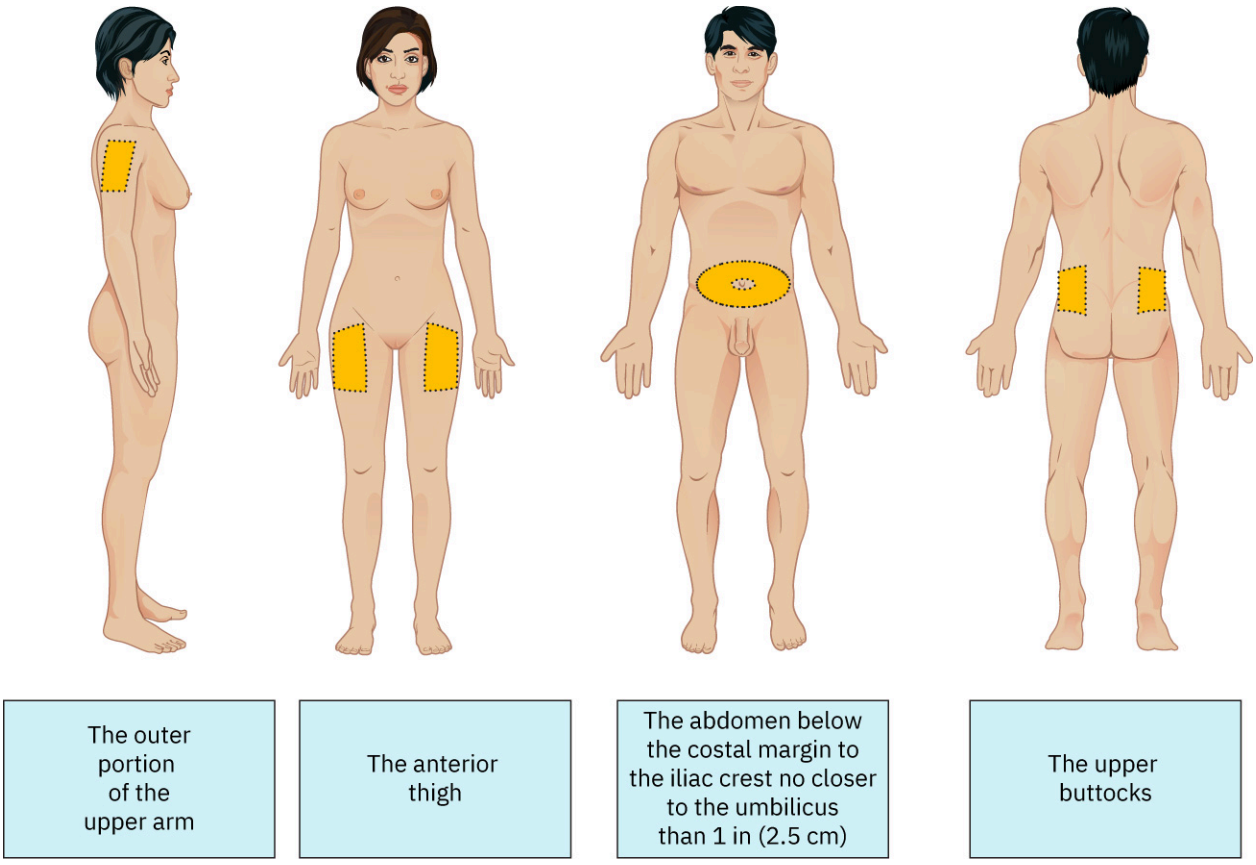


FIGURE 12.30 This illustration shows the anatomical sites appropriate for administering SQ injections. The upper back is another appropriate SQ injection site. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Common Medications Given Subcutaneously

Subcutaneous administration may be used to administer a variety of medications because of its high bioavailability and rapid onset of action. Medications administered subcutaneously are given in small amounts, typically 1 mL or less. Examples of medications that may be administered via the SQ route include narcotics, antiemetics, heparin, fertility medications, and insulin.

Narcotics

Pain is a very common symptom in patients with advanced cancer. One means to assist with pain control for this population is with SQ injections of narcotics. Due to the slower rate of absorption, intermittent SQ injections of narcotics may be added to the pain relief regime to offer better pain control. Most opioids, such as morphine, fentanyl, and tramadol, can be administered subcutaneously. Often, these medications will be delivered to the patient via an indwelling subcutaneous needle attached to a portable injector device that can be set to deliver a certain amount of the medication at given intervals.

Antiemetics

Antiemetics, such as metoclopramide (Reglan) or dexamethasone (Decadron), may be administered subcutaneously. This route may be the preferred route when the patient is vomiting, oral absorption is in doubt, or there is no IV access. Subcutaneous antiemetics are often used for patients with advanced cancer and those under palliative care.

Heparin

Heparin is a high-alert medication used to reduce the risk of blood clot formation. Heparin may be supplied in vials or prefilled syringes. The syringes usually come in an identifiable color with tiny numbering specific for heparin dosing. If heparin is supplied in a vial, always use an official heparin syringe to withdraw the medication. There are multiple concentrations of heparin, which substantially increases the risk to the patient of a medication error. To help prevent a wrong dose or wrong concentration error, two nurses are required to double-check the medication

before administration. The nurse should review laboratory results, such as partial thromboplastic time (PTT) and activated partial thromboplastin time (aPTT) that characterize blood coagulation, before administering heparin to ensure the correct dose of the medication is administered to the patient. Risks associated with heparin include bleeding, hematuria, hematemesis, bleeding gums, and melena (dark, tarry stools indicative of gastrointestinal bleeding). Heparin sites should be rotated because of the risk of changes in skin appearance and texture. Typically, the abdominal area, at least 2 in (5 cm) away from the umbilicus, is preferred because this site results in the least amount of bruising and pain for the patient. Heparin should be injected at a 90-degree angle and administered over a thirty-second period to allow time for the subcutaneous tissue to accommodate the injected volume. Injecting heparin slowly reduces pressure to the site, capillary bleeding, and site pain. Do not massage the injection site after administering heparin because this may create a hematoma.

When administering heparin, it is also important to assess the patient's medical conditions and medications before administration. Due to the risk of bleeding, heparin should not be given when the patient is at an increased risk of hemorrhage. For example, heparin would be contraindicated for individuals experiencing severe trauma, a cerebral vascular accident, or recent childbirth. The nurse would also want to assess over-the-counter or herbal medications that may interact with heparin (e.g., aspirin, garlic, ginger, nonsteroidal anti-inflammatory drugs [NSAIDs]) or other prescription medications that may interact with heparin (e.g., thrombolytics and lisinopril).

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Types of Heparin Preparations

Heparin is a medication commonly used to prevent blood clot formation. It comes in various forms for different medical purposes, including subcutaneous (SQ) injections, heparin locks, and heparin flushes.

- Heparin SQ injection: Subcutaneous injections of heparin are often used for prophylaxis against deep vein thrombosis (DVT) or to prevent blood clots in certain medical conditions.
- Heparin lock (Heparin lock flush): A heparin lock involves placing a small amount of heparin solution into an intravenous (IV) catheter when it is not actively in use to keep the IV line open and help prevent clot formation.
- Heparin flush: A heparin flush is similar to a heparin lock but involves using a small amount of heparin solution to flush IV lines after medication administration to ensure the medication is fully delivered and blood clots do not form in the IV line.

Fertility Medications

Fertility medications (e.g., leuprolide [Lupron], chorionic gonadotropin [Ovidrel], menotropin [Menopur], and follicle-stimulating hormone [Gonal-F]) may be administered subcutaneously to stimulate multiple egg development. Typically, they are injected into the stomach, at least 1 in (2.5 cm) away from the umbilicus, or the top of the thighs; however, they may also be administered in the adipose tissue found in the back of the arm. Rotating the site with each injection will help to reduce pain and discomfort. Typically, these medications are self-administered; therefore, it is important for the nurse to teach the patient how to safely administer the medication, cleanse the site with an alcohol swab before administering the medication, and dispose of the used needles and syringes. Education may also require helping the patient to overcome their fear of injections by using ice for fifteen to thirty seconds before administration to numb the site and experimenting with various sites to locate the least-sensitive areas.

Insulin

Insulin is one of the most commonly administered subcutaneous medications. It is considered a high-risk medication; therefore, special care must be taken to ensure the patient's safety, including having two nurses double-check the insulin type and dosage with the medication administration record while drawing up the medication and again before administration. Insulin must be administered using an insulin syringe. Insulin syringes come in 30-, 50-, and 100-unit measurements, which are carefully calibrated to ensure accuracy. If administering more than one type of insulin, consideration should be given regarding whether the insulins can be mixed and adhering to proper procedures for mixing insulins (see Mixing Insulins).

Insulin should be stored in the refrigerator until it is ready to be used. After the vial is opened, it may then be stored

at room temperature according to the agency's policy. If the vial is cold, allow the insulin to come to room temperature before administering the medication. The insulin vial should always be inspected before use to ensure the insulin administered is the type of insulin prescribed. The vial should not be expired and any abnormalities in the insulin solution should be noted. For example, if the solution is frosted, discolored, has clumps, or is cloudy (and is supposed to be clear), then return the vial to the pharmacy and retrieve a new vial.

When administering insulin, the timing of the administration is critical. Short- or rapid-acting medications should be administered within fifteen minutes of the mealtime. Intermediate-acting insulins may be taken with breakfast and dinner, and long-acting insulins may be given at bedtime. Knowing the peak action and duration of insulin is critical before administration. In addition, blood sugar levels should be tested regularly and the results assessed before administering insulin, according to the agency's policy.

Insulin absorption rates vary depending on the site. The abdomen absorbs the fastest, followed by the arms, thighs, and buttocks. Rotating the injection sites within one anatomical area each day may help to maintain consistent insulin absorption. For example, various sites within the back of the left arm may be used throughout the day. The following day, various sites on the abdomen may be used. When possible, allow the patient to choose the injection site. Depending on the agency's policy, patients may self-administer insulin if it is determined to be safe according to their condition.

Steps for Administration of SQ Injections

Safe administration of SQ injections requires following proper technique. The nurse performs hand hygiene before drawing up the medication and before and after administering the medication. After selecting the appropriate site for an SQ injection, the nurse cleans the skin with an alcohol swab, allowing the skin to dry completely. The nurse holds the syringe at a 45- to 90-degree angle from the site with the bevel up, which allows for smooth introduction of the needle into the SQ tissue (see Figure 12.10). The degree angle and the length of the needle used will depend on the amount of subcutaneous tissue present. A 90-degree angle is used for normal-sized adult patients with adequate fatty tissue or patients who are obese with significant fatty tissue. A 45-degree angle is used for patients who are thin or have minimal fatty tissue.

Before giving the injection, grasp or pinch the skin to pull the tissue away from the muscle. Use caution to ensure the needle does not pierce through the other side of the skin fold and accidentally stick the nurse. Inject the needle into the skin using a quick, dart-like motion and slowly inject the medication at a rate of approximately 10 seconds per mL. Aspiration is not necessary because the likelihood of injecting the medication into a blood vessel is small. After administration, the nurse removes the needle at the same angle in which it was introduced into the skin, applies gentle pressure to the site with a sterile gauze, engages the needle safety device, and discards the syringe in a sharps container. Do not massage the area after the injection because this may cause damage to the underlying tissue.

LINK TO LEARNING

You can view how to administer a subcutaneous medication (https://openstax.org/r/77subcutaneous) in this video demonstration.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering a Subcutaneous Injection

See the competency checklist for Administering a Subcutaneous Injection. You can find the checklists on the Student resources tab of your book page on openstax.org.

Needle Size and Syringe Type

When administering a subcutaneous injection, a 25- to 30-gauge needle that is 3/8 to 5/8 in (9.5 to 16 mm) long is used. Some injections may come in a prefilled syringe with the needle attached, while other injections may need to

be drawn up from a vial. If the medication is drawn from a vial, a 1 to 3 mL hypodermic syringe is used for most SQ injections. Insulin, however, may only be administered using an insulin syringe. Regardless of the syringe type, always confirm the needle size is appropriate for the patient before administering the medication.

12.6 Administering Intramuscular Injections

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the guidelines for using the intramuscular (IM) route for medication administration
- Identify common medications administered via the IM route
- Demonstrate the steps for administering IM injections

Parenteral medications injected into a muscle are known as intramuscular (IM) injections. This route allows for rapid absorption of medications; therefore, certain medications are well-suited for the IM route. The nurse must be able to accurately perform the steps for administration, including selecting an appropriate muscle and needle size, and using proper technique. This section will provide you with the knowledge to safely administer medications via the IM route.

Guidelines for Using the IM Route

Medications administered via the intramuscular route are injected directly into the muscle. Muscle tissue has a large blood supply; therefore, IM medications may be absorbed faster than those injected via the SQ route. However, any factor that affects blood flow will adversely affect the rate of absorption. Proper administration techniques must be followed to avoid complications, such as muscle atrophy, injury to the bone, abscesses, pain, nerve injury, and cellulitis. To ensure the medication is administered into the muscle, careful consideration must be given to selecting an appropriate anatomical site for the IM injection.

Anatomical Sites for IM Injections

When administering medications via the IM route, it is important to select an appropriate anatomical site. Site selection depends on a number of factors, including the patient's age, condition, type of medication to be administered, and volume of medication required. The most commonly used sites for adults and children greater than 18 months old include the deltoid, vastus lateralis, and ventrogluteal muscles. For children less than 18 months old, the vastus lateralis of the thigh should be used because it is the most developed muscle at that age.

The deltoid (Figure 12.31) is a triangle-shaped muscle in the upper arm that is easy to locate and access. The injection site is in the middle of the deltoid muscle, approximately 1 to 2 in (2.5 to 5 cm) below the acromion process. To locate the deltoid muscle, expose the upper arm and have the patient relax their arm. Locate the acromion process (bony prominence of the scapula) and lay three fingers horizontally below the acromion process (Figure 12.31). Three finger's breadth from the acromion process typically falls in the middle of the muscle, which helps reduce the risk of injecting the medication into the subcutaneous tissue, nerves, or joints.

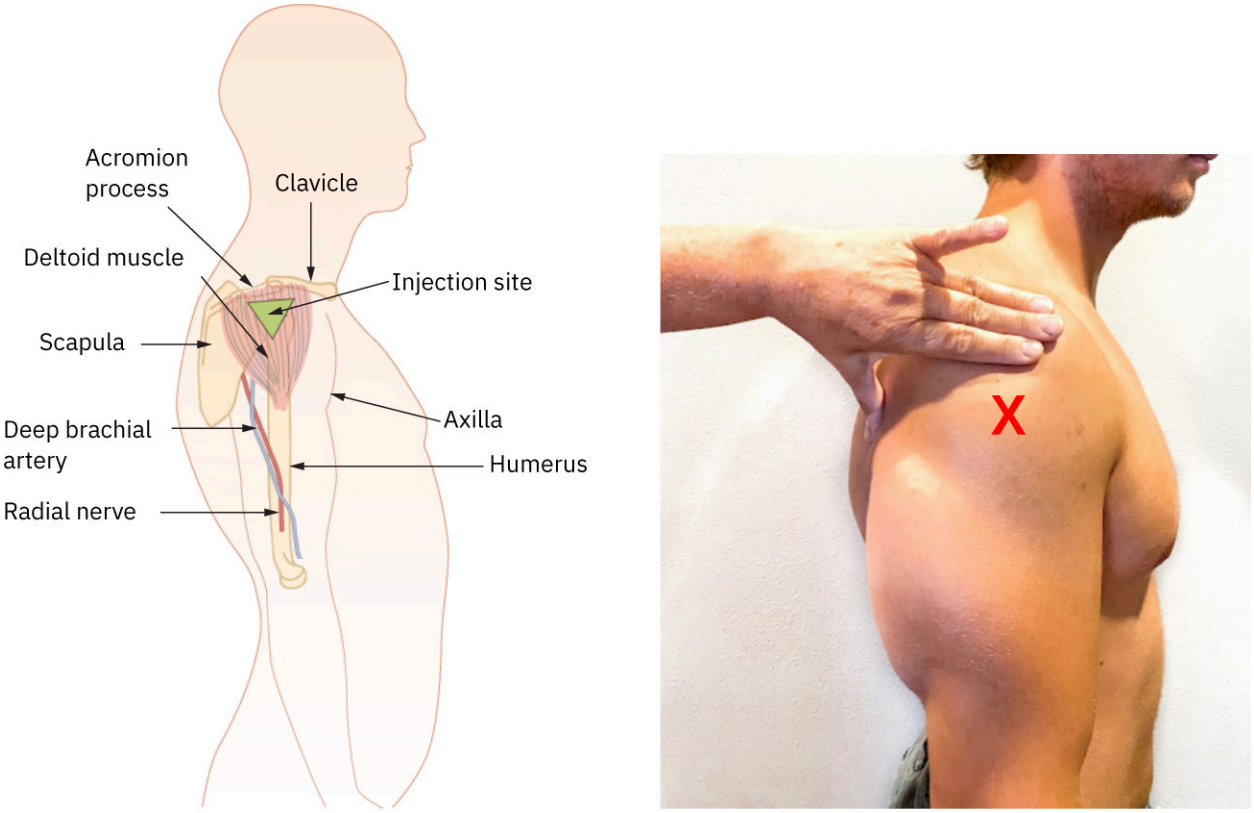


FIGURE 12.31 (a) The deltoid is a triangular muscle that can (b) be located on the outer aspect of the shoulder. (credit a: modification of "Im-deltoid" by British Columbia Institute of Technology/Wikimedia Commons, CC BY 4.0; credit b: modification of "Sept-22-2015.11.jpg" by British Columbia Institute of Technology, CC BY 4.0)

The vastus lateralis (Figure 12.32) is located on the anterior lateral aspect of the thigh. It extends from one hand's breadth above the knee to one hand's breadth below the greater trochanter. The vastus lateralis is the preferred site for children less than 18 months old because typically this muscle is well-developed. To locate the site, have the patient lie flat with their knees slightly bent or move to a sitting position.

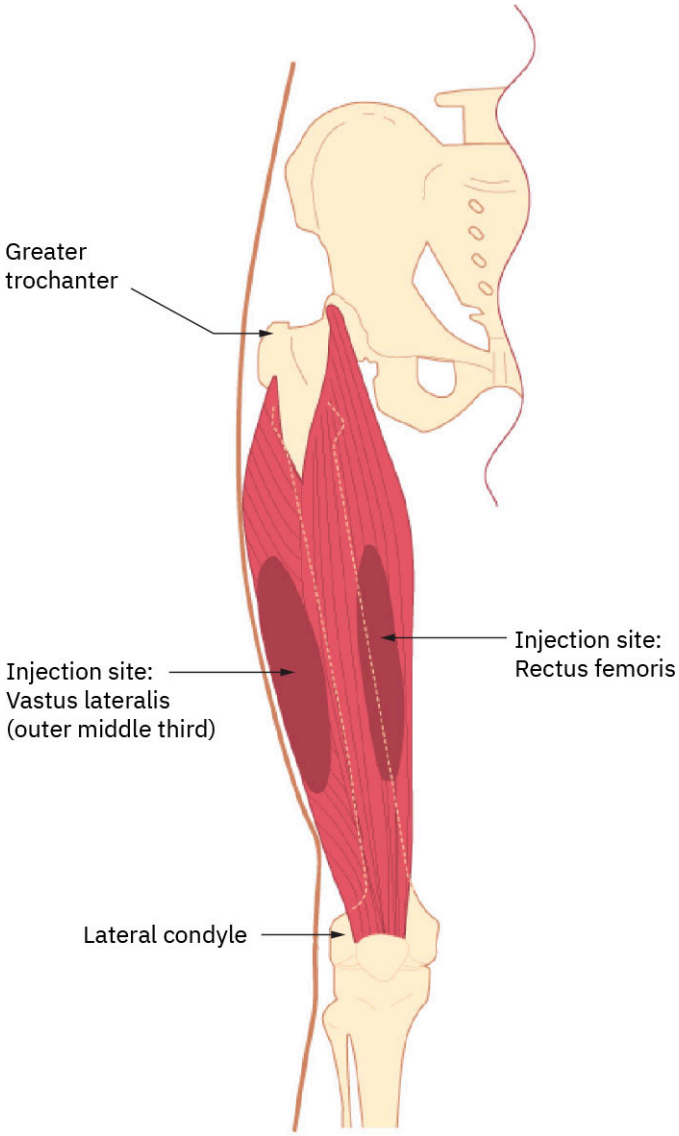


FIGURE 12.32 This illustration shows where to locate the vastus lateralis site. (credit: modification of "Im-vastus-lateralis.png" by British Columbia Institute of Technology/Wikimedia Commons, CC BY 4.0)

The ventrogluteal site (Figure 12.33) involves the gluteus medius and minimus muscles. It is considered to be one of the safest intramuscular sites because of the thickness of the gluteal muscles, the thinness of the fat, and the lack of nerves and blood vessels present. It is also the preferred site for solutions that are oily or known to be irritating. After the patient is positioned in the supine or lateral position (on their side), the nurse feels for the hip. Using the left hand for the right hip or your right hand for the left hip, the nurse places the palm on the greater trochanter, with the thumb pointing toward the umbilicus. The nurse moves the index finger toward the anterior superior iliac spine and the middle finger toward the iliac crest to create a V shape between the index and middle fingers.

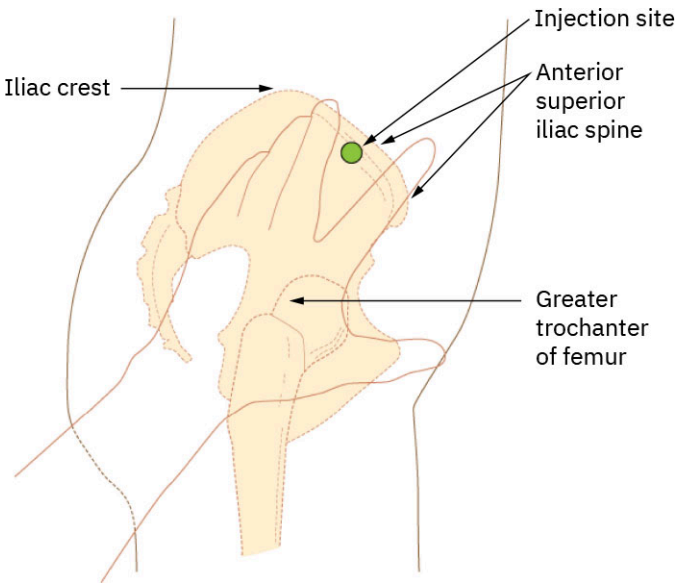


FIGURE 12.33 This illustration demonstrates how to locate the ventrogluteal site for IM medication injections. (credit: modification of "Im-ventrogluteal-300x244.png" by British Columbia Institute of Technology/Wikimedia Commons, CC BY 4.0)

The site selected should be free from pain, infection, abrasions, and necrosis. Avoid sites with atrophied muscle because the muscle may not be able to absorb the medication. Avoid the dorsogluteal site unless otherwise recommended because of the increased risk of injury including sciatic nerve damage and paralysis of the leg. Rotating sites should be considered if IM injections are repeatedly administered to decrease the risk of hypertrophy.

Common Medications Given Intramuscularly

Intramuscular injections may be used to administer a variety of medications because of the quick absorption rate and prolonged action. Provided the size of muscle tissues, the IM route is preferred to the ID and SQ routes when larger volumes of fluid need to be administered or the solution may be concentrated or viscous. Examples of medications that may be administered via the IM route include narcotics, antibiotics, vaccinations, immunoglobulins, and hormonal medications.

Narcotics

Narcotics administered via the IM route have a slower and more variable onset than when administered via the IV route. Caution must be taken when injecting narcotics into chilled bodily areas or in patients with hypotension or shock. These circumstances prevent complete absorption of the medication; therefore, repeated injections may cause excessive amounts of the medication to be absorbed at once if normal circulation is re-established. Common narcotics administered via the IM route include meperidine (Demerol), morphine, and fentanyl.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: What to Do If a Reaction Occurs

Intramuscular injections may cause an injection site reaction. Symptoms of an injection site reaction include redness, swelling, warmth, mild pain or discomfort, itching, or a lump under the skin. Usually, these symptoms are not dangerous and subside within one to two days. To reduce the pain and provide comfort for the patient, warm or cold compresses may be applied in ten- to twenty-minute increments, over-the-counter pain relievers may be administered, and diphenhydramine (Benadryl) may be provided to reduce itching.

More serious symptoms, such as fever, hives, trouble breathing, severe pain, joint pain, blisters at the injection site, and facial swelling may indicate a more serious reaction to the medication and should always be communicated to the provider. In these instances, the patient may be experiencing anaphylaxis and may need emergent treatment, such as cardiopulmonary resuscitation, an epinephrine injection, or other emergency medications. The onset of action with IM narcotics is variable; therefore, the patient must also be monitored for potential overdose. Should an

overdose occur, naloxone (Narcan), an opioid antagonist, may be administered intramuscularly to reverse the effects of the narcotic medication.

Antibiotics

Intramuscular antibiotics may be indicated to treat bacterial infections, as well as when the patient is unable to tolerate oral medications or when the patient is noncompliant with taking medications. Common antibiotics administered via the IM route include penicillin, streptomycin, and ceftriaxone (Rocephin). Depending on the required dose, it may be necessary to inject more than one shot within a single dose (see Volume Limits for Different Routes). Antibiotics, such as penicillin, are administered by deep IM injection into the ventrogluteal site. Gently massaging the injection site or walking around may help to alleviate some of the pain associated with administering antibiotics via the IM route.

Vaccinations

Vaccines are one of the most commonly administered IM injections. The deltoid is the preferred site for most adult vaccinations, whereas the vastus lateralis is the preferred site for children less than 18 months old. There are no large blood vessels near these preferred sites; therefore, there is very little risk of the vaccine entering the bloodstream, so do not aspirate when administering vaccines. If administering more than one vaccine, leave at least 1 in (2.5 cm) between vaccination sites, if possible. Vaccines commonly administered via the IM route include influenza, COVID-19, hepatitis A, hepatitis B, meningococcal, pneumococcal, tetanus, and human papillomavirus.

LIFE-STAGE CONTEXT

Administering Vaccinations to Children

Injections can be scary for children and may invoke anxiety. Nurses play a critical role in creating a positive immunization experience for the patient. When administering vaccines to children, it is important to pay attention to facial expressions, body language, and comments; use a safe, calm voice; make eye contact with the child not just the parent; explain why the vaccine is needed in words the child can understand; and be honest about what the child may experience during the procedure. To reduce fear and pain, refer to the medication as a "vaccine" instead of a "shot," which has a negative connotation. Also, allow children to sit upright instead of having them lay down. Parent participation has also been shown to increase children's comfort level. Therefore, the parent should be encouraged to hold the child during administration of the vaccine. The parent should be instructed on how to help hold the child still during the injection, such as swaddling an infant, having the child sit in their parent's lap with their legs positioned between their parent's thighs, and bear-hugging the child's arms. Depending on the dose of the medication and the size of the patient, the dose may need to be divided between more than one site to adhere to volume limits per muscle. After the procedure, always praise the child for being brave throughout the procedure.

Older children and adolescents may be at risk of fainting after vaccinations. Before administering a vaccine, ask the patient if they have ever fainted. If so, position the patient so they are lying down to enhance safety should they faint. Be aware of symptoms such as weakness, dizziness, and pallor, which may indicate the onset of fainting. If any of these symptoms are present, have the patient lie down and monitor them for fifteen to twenty minutes after the injection. After symptoms resolve, instruct the patient to move in small increments, such as sitting upright with the legs elevated, then lowering the legs, and then finally standing.

Immunoglobulins

Immunoglobulins are antibodies that are administered to help fight infections. They are made from healthy human blood that contains high levels of antibodies. Immunoglobulins should be administered as soon as possible after having been exposed to infection because they may not be effective if too much time has passed since the exposure. Immunoglobulins are commonly administered via the IM route for exposures to hepatitis A, measles, chicken pox, or rubella. Side effects of immunoglobulins include muscle stiffness, redness, warmth, pain, and tenderness at the injection site. Immunoglobulins are created using human blood; therefore, they may contain substances that could cause infection, though rare. Therefore, it is important to consider the risks and benefits of the medication and to report persistent sore throat/fever, yellowing of the eyes or skin, or dark urine. Consideration should also be given to any live vaccines that may have recently been administered because the response of these

vaccines may be reduced with subsequent administration of immunoglobulins.

Hormonal Medications

Hormonal medications may be given to replace a hormone when the body does not make enough of it. Common hormonal medications administered via the IM route include testosterone, estrogen, and progesterone. These medications are prepared in a liquid form suspended in oil. Typically, hormonal medications are administered in the dorsogluteal site (the upper, outer buttocks). To identify the correct site, visually divide the buttocks into four quadrants and use the upper, outer quadrant for the injection. The buttocks contain large blood vessels; therefore, always aspirate before injecting the medication. Oil-based solutions are known to be irritating and painful for the patient. To prevent unnecessary pain for the patient, oil-based solutions should be given with 18- to 21-gauge needles because it takes more force to push the oil-based solution through smaller needles. Instructing the patient to gently massage the injection site will help to break up the oil and promote absorption. Sometimes, oil-based solutions may cause little knots to form where the oil has accumulated. To avoid tissue damage and further buildup of the oil, rotate the injection sites and do not inject within 1 in (2.5 cm) of any knot formations.

Steps for Administration of IM Injections

Safe administration of IM injections requires following proper technique. When administering IM injections, it is important to select an appropriate site for administration. After selecting the site, the nurse cleans the skin with an alcohol swab and then allows the skin to dry completely. The nurse holds the syringe at a 90-degree angle from the site with the bevel up, which allows for smooth introduction of the needle into the muscular tissue (see Figure 12.10).

When administering IM injections, the nurse holds the skin around the injection site to secure the area for injection. Grasping the muscle may be especially important with pediatric and geriatric patients who typically have less adipose tissue to ensure the needle is injected into the muscle and does not pierce through the muscle and into the bone. The nurse inserts the needle into the skin using a quick, darting motion. When the needle is inserted all the way into the skin, the nurse performs **aspiration** (if required by agency policy) by pulling back on the plunger to check for blood return. Lack of blood return confirms that the needle is in the muscle and not in a blood vessel. If blood return is noted, the nurse removes the needle, discards the dose, and prepares another dose of the medication. The nurse slowly injects the medication at a rate of approximately 10 seconds per mL, unless otherwise indicated. After the dose is administered, the nurse removes the needle at the same angle in which it was introduced into the skin, then applies gentle pressure to the site with a sterile gauze, engages the needle safety device, and discards the syringe in a sharps container.

LINK TO LEARNING

You can view how to administer an intramuscular medication (https://openstax.org/r/77intramuscular) in this video demonstration.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering an Intramuscular Injection

See the competency checklist for Administering an Intramuscular Injection. You can find the checklists on the Student resources tab of your book page on openstax.org.

The **Z-track method** (Figure 12.34) may be used for all IM injections when the overlying tissue can be displaced. This method creates a zigzag path that prevents the medication from leaking into the subcutaneous tissue by altering the track created by the needle. To perform the Z-track method, the nurse pulls the skin down or to the side about 1 in (2.5 cm), away from the injection site and aspirates, if required by agency policy. The nurse then slowly injects the medication while still pulling the skin down or to the side. After the medication has been administered, the nurse leaves the syringe in place for ten seconds to allow the medication to be displaced. After withdrawing the needle, the nurse then releases the skin. Displacement of the skin closes off the needle track after the skin is

released.

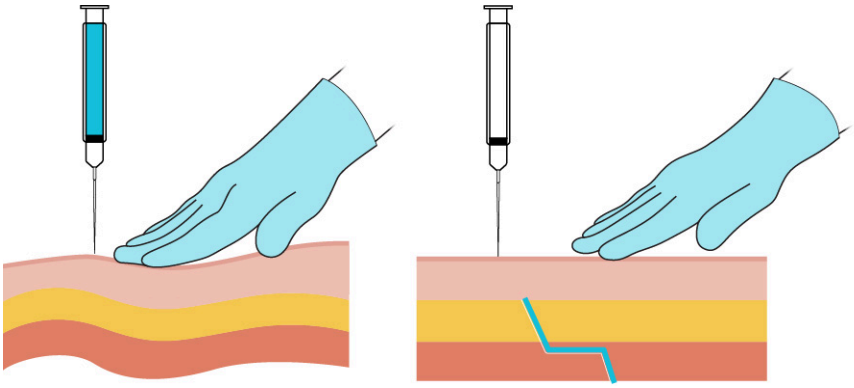


FIGURE 12.34 This illustration shows how to perform the Z-track method of IM medication administration. (credit: "Z-track-process-1.jpg" and "Z-track-process-3.png" by British Columbia Institute of Technology, CC BY 4.0.)

Needle Size and Syringe Type

When administering an IM injection, it is important to select a needle appropriate for the patient's body composition and amount of adipose tissue, age, type of medication, volume of the medication to be administered, as well as the viscosity of the medication (Table 12.2). The length of the needle must be long enough to be injected into the muscle. Typically, 5/8 to 1.5 in (16 to 38 mm) needles are used for IM injections in adults; 1.5 in (38 mm) needles are used when there is more adipose tissue present and 5/8 in (16 mm) needles are used where there is less adipose tissue. As a general guideline, a 5/8 in (16 mm) needle may be appropriate for adults weighing less than 130 lbs (59 kg), a 1 in (25.4 mm) needle may be ideal for those weighing between 130 and 260 lbs (59 and 118 kg), and a 1.5 in (38 mm) needle would be appropriate for those weighing greater than 260 lbs (118 kg). General guidelines may be formulated based on how much the patient weighs; however, the patient's body composition and amount of adipose tissue present should also be considered. Children and infants require shorter needles. Refer to the agency's policies regarding needle length for children.

Length of Required Needle		
Length of Needle	**Patient's Weight**	**Quantity of Adipose Tissue**
5/8 in (13 mm)	< 130 lbs (59 kg)	Minimal
1 in (25.4 mm)	130 to 260 lbs (59–118 kg)	Normal
1.5 in (38 mm)	> 260 lbs (118 kg)	Large or excessive

Diameter of Required Needle	
Gauge of Needle	**Medication Composition**
20G to 25G	Aqueous solution
18G to 21G	Viscous or oil-based solution

TABLE 12.2 Size and Diameter of Needles

In addition to the length of the needle, it is also important to select the correct gauge of needle. The gauge of the needle is dependent upon the solution to be administered. Aqueous solutions may be given using a 20G to 25G needle, oil-based solutions require an 18G to 21G needle, and immunizations require a 22G to 25G needle. Typically, a 22G to 25G needle is used with children. If the solution to be injected is aqueous, a 25G needle would be the appropriate choice, whereas a 22G needle would be a better choice if the solution is viscous or oil based.

When administering IM injections, the medication may need to be withdrawn from a vial or it may come packaged as a prefilled syringe. If the medication is packaged in a vial, select an appropriate syringe according to the amount of volume to be injected, typically a 1 to 3 mL hypodermic syringe. Attach the needle to the syringe and withdraw the medication from the vial. Replace the needle with a new needle appropriate for the injection site because the needle used to withdraw the medication from the vial is dulled after it pierces the vial. If the medication is packaged as a prefilled syringe, simply attach the needle to be used for the injection to the prefilled syringe.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Selecting the Correct Needle Size

Before taking action to select the correct needle size, the nurse must first recognize the associated cues. For example, the nurse read the order for influenza vaccine 0.5 mL IM times one dose to be administered to a 25-year-old patient who weighs 150 lbs (68 kg). The nurse analyzes the cues to realize the influenza vaccine is an aqueous solution that should be administered in the patient's deltoid muscle. Given this vaccine must be administered intramuscularly, the nurse hypothesizes that a 5/8 to 1.5 in (13 to 38 mm), 22G to 25G needle will be needed for the injection. The nurse considers the options that are available within these size ranges (generates solutions) and decides to use a 1 in (25.4 mm), 25G needle. A 1 in (25.4 mm) needle was selected from the possible lengths based on the patient's weight of 150 lbs (68 kg), and a 25G gauge needle was selected based on the fact that the medication is an aqueous solution.

Summary

12.1 Administering Oral Medications

Oral medications may be administered via the oral, sublingual, buccal, or feeding tube route. Before administering oral medications, it is important for the nurse to consider the preparation of the medication because preparation has implications for how the medication should be administered. By following the steps of oral medication administration, ensuring the medication "rights" are confirmed at the three checkpoints, and following appropriate delegation procedures, the nurse may ensure safe administration of oral medications.

12.2 Administering Parenteral Medications

Parenteral medications are injected directly into the tissues and circulatory system, thus bypassing the gastrointestinal tract. Administering medications parenterally eliminates the effects of first-pass metabolism, allows for faster onset, and provides stronger effects than oral medications. Common routes for parenteral medication administration include intramuscular, subcutaneous, intravenous, and intradermal. When administering parenteral medications, it is essential to ensure the safety of both the patient and the nurse. Guidelines for ensuring safety include confirming the medication rights and protecting sterility. These guidelines also ensure that the appropriate procedures for administration are followed, which include cleansing the site, engaging needle safety devices, and ensuring proper disposal of needles. When administering parenteral medications, the nurse is responsible for gathering the necessary equipment, including syringes, needles, or needleless systems. The equipment used will depend on a number of factors, including the type of medication, location of injection, amount of medication required, and the size of the patient.

12.3 Preparing Unit-Dose Packaged Medications

Vials store liquid or powder medications that are administered via the parenteral route. They may be single-use (used one time for one patient) or multidose in which a dose may be administered to one or more patients. When removing medication from a vial, always check the expiration date before use, remove the plastic cap, and wipe the rubber stopper with an alcohol swab. Inject air equivalent to the desired dose into the vial before withdrawing the medication.

Ampules are small glass containers that hold a single dose of liquid medication. Caution must be taken to prevent cutting yourself on the broken glass. A filtered needle must be used to withdraw the medication, and the ampule must be disposed of in the sharps container. Medications also may come prepared in prefilled cartridges, such as injector devices and prefilled syringes. Other medications may come supplied as a powder and require a liquid to be added to reconstitute the medication into a solution form that would be suitable for parenteral administration. Medications may be mixed in one syringe if they are compatible and the total volume does not exceed the maximum volume for the site of injection. Long-acting insulins may never be mixed.

12.4 Administering Intradermal Injections

Intradermal medications are injected into the dermis. The ID route has the most prolonged absorption time of the various parenteral routes because there are fewer blood vessels and no muscle tissue available to distribute the medications. Common sites for ID injections include the anterior surface of the forearm, posterior surface of the upper arm, the upper back and under the scapula, and upper chest. A variety of medications may be administered intradermally, including Botox injections, allergy testing, steroids, local anesthesia, and TB testing.

Intradermal injections are administered at a 5- to 15-degree angle, using a 26G to 27G gauge needle that is 0.25 to 0.5 in (6.4 to 13 mm) long. Prior to injecting the medication, the nurse holds the skin taut, inserts the needle into the skin with the bevel up, and slowly injects the medication. Presence of a wheal confirms placement into the dermis.

12.5 Administering Subcutaneous Injections

Subcutaneous medications are injected beneath the skin into the adipose tissue. Medications administered via this route have a slow, sustained rate of absorption because of a lack of blood vessels found within the tissue. The most commonly used sites include the outer portion of the upper arm, the upper back, the abdomen below the costal margin to the iliac crest no closer to the umbilicus than 1 in (2.5 cm), the upper ventral gluteal region, and the anterior thigh. A variety of medications may be given subcutaneously, including narcotics, antiemetics, heparin,

fertility medications, and insulin. Subcutaneous injections are administered at a 45- to 90-degree angle, using a 25- to 30-gauge needle that is 3/8 to 5/8 in (9.5 to 16 mm) long. Before injecting the medication, grasp or pinch the skin to pull the adipose tissue away from the muscle. Inject the needle into the skin using a quick, dart-like motion and slowly inject the medication at a rate of approximately 10 seconds per mL.

12.6 Administering Intramuscular Injections

Intramuscular medications are injected directly into the muscle. Medications administered via the IM route may be absorbed faster than those injected via the SQ or ID routes because of the increased blood supply found within muscles. Common sites for IM injections include the deltoid, vastus lateralis, and ventrogluteal muscles, depending on the patient's age, condition, type of medication to be administered, and volume of medication required. The IM route is preferred when larger volumes of fluids are required or the solution is concentrated, viscous, or oil based. A variety of medications may be given intramuscularly, including narcotics, antibiotics, vaccines, immunoglobulins, and hormonal medications.

Intramuscular injections are administered at a 90-degree angle, using a 5/8 to 1.5 in (13 to 38 mm) long, 18G to 25G needle, depending on the patient's body composition and amount of adipose tissue, age, type of medication, amount of the medication to be administered, and viscosity of the medication. Before injecting the medication, hold the skin or use the Z-track method to secure the area for the injection. Aspirate (if required by agency policy) by pulling back on the plunger to check for blood return, then slowly inject the medication at a rate of approximately 10 seconds per mL, unless otherwise indicated.

Key Terms

ampule a glass container that holds a single dose of liquid medication
aspiration pulling back on the plunger to assess for blood return prior to injecting a medication
bevel sharp, angled tip of the needle
buccal placed between the gum and cheek
caplet solid, compressed powder or granules
capsule a powder or granules contained in a gelatin shell
compatibility the capability of administering two or more medications together without the two interacting with one another
diluent the liquid used to dilute a powdered medication into a liquid form
elixir a liquid form of a medication that contains added sugars, flavors, and alcohol
emulsion a solution that contains a medication, water, and oil mixture
enteric-coated tablet a tablet covered in a substance that delays the medication from dissolving
gauge the diameter of the hole in a needle
gelcap a soft gelatin shell with a liquid medication inside
injector device a spring-loaded syringe that delivers a single, preloaded dose of a medication when the device is firmly pressed against the body
intradermal (ID) a medication route that injects the medication into the dermis
intramuscular (IM) a medication route that injects the medication into a muscle
intrathecal a medication route that injects the medication into the subarachnoid space around the spinal cord
intravenous (IV) a medication route that injects the medication into a vein
lipoatrophy the selective loss of subcutaneous fat without exudative reaction or fibrosis
lipohypertrophy a lump of fatty tissue under the skin caused by repeated injections in the same place
lozenge a medication with a candy base
Mantoux tuberculin skin test (TST) a skin test used to diagnose latent TB
needle a hollow metal tube with a sharp pointed tip, called a bevel, and a hub that attaches the needle to the syringe or a needleless system
needleless system a system that allows parenteral medications to be administered without the use of a needle
parenteral a medication route that bypasses the gastrointestinal (GI) system, eliminating the effects of first-pass metabolism when they are digested in the GI tract
powder fine particles created from grinding a solid
prefilled syringe a disposable syringe that is supplied with the necessary amount of the medication to be injected in a single dose

reconstitute to add a liquid to a powdered medication to form a solution
subcutaneous (SQ) a medication route that injects the medication into the adipose tissue
sublingual placed under the tongue
suspension undissolved medication particles that are mixed with a liquid agent
syringe a sterile device that consists of a calibrated, cylinder-shaped barrel with a sliding plunger at one end and an open tip that attaches to a needle at the other end
syrup a liquid form of a medication that contains added sugars and flavors
tablet a compressed powder that has been formed into a solid, which disintegrates with body warmth and may be absorbed into the bloodstream
time-released slow release of a medication for prolonged action
vial a plastic or glass container with a rubber stopper on top that contains a liquid medication
wheal a visible induration (elevation) of the skin
Z-track method a method of IM medication administration that helps prevent the medication from leaking into the subcutaneous tissue

Assessments

Review Questions

1. A medication is ordered sublingual. How should the nurse administer the medication?
   a. Place the medication on top of the tongue.
   b. Place the medication between the gum and cheek.
   c. Instruct the patient to swallow the medication.
   d. Place the medication under the tongue.

2. A patient is ordered an enteric-coated medication PO (by mouth) TID (three times a day); however, the patient is having difficulty swallowing the tablet. What action should the nurse take?
   a. Contact the prescribing provider to discuss alternatives.
   b. Divide the tablet in half using a pill splitter.
   c. Dissolve the tablet in a small amount of liquid.
   d. Crush the tablet and place it in applesauce.

3. The nurse is preparing to administer insulin to a patient. What is the correct site for injecting this medication?
   a. the muscle
   b. the dermis
   c. the adipose tissue
   d. the vein

4. Which needle size would be most appropriate for administering either an intradermal (ID) or subcutaneous (SQ) injection?
   a. 0.5 in (13 mm), 26G
   b. 0.25 in (6.4 mm), 27G
   c. 5/8 in (16 mm), 28G
   d. 0.25 in (6.4 mm), 25G

5. Sterility is a key safety factor to consider when administering parenteral medications. Which equipment pieces must remain sterile?
   a. needle, syringe tip, flange
   b. barrel, needle shaft, plunger
   c. plunger, Luer-lock, needle hub
   d. Luer-lock, flange, needle cap

6. The nurse preceptor is working with a new graduate nurse. What statement by the new graduate nurse demonstrates a correct understanding of how parenteral medications work?

a. "Compared to oral administration, medications administered via the parenteral route have a slower onset."
b. "Compared to oral administration, medications administered via the parenteral route provide weaker effects because they are not digested in the gastrointestinal tract."
c. "Medications administered via the parenteral route are affected by first-pass metabolism."
d. "The parenteral route is used for medication administration when a precise serum medication level is needed."

7. The nurse is administering parenteral medications with a student nurse. What action would be of concern to the nurse?
a. The student uses a hard surface to close the safety device on the needle.
b. The student slowly injects the medication at a rate of 10 seconds per milliliter.
c. The student cleanses the skin with an alcohol swab for thirty seconds and allows the site to dry for fifteen seconds.
d. The student cleans the site from the center of the site and moves outward in a 2 in (5 cm) radius.

8. The nurse is preparing a medication from a glass ampule. What actions taken by the nurse would warrant further education?
a. wiping the scored line with an alcohol swab before breaking the head off the ampule
b. drawing up air equivalent to the amount of medication to be administered
c. using a filtered needle to withdraw the medication from the ampule
d. using a gauze to snap off the head of the ampule, away from the nurse's body

9. The nurse is administering an intradermal injection. What is the proper technique for administering ID injections?
a. Hold the syringe at a 10- to 15-degree angle from the site and insert the needle about 0.25 in (6.4 mm).
b. Hold the syringe at a 10- to 20-degree angle from the site and insert the needle about 0.25 in (6.4 mm).
c. Hold the syringe at a 5- to 15-degree angle from the site and insert the needle about 0.5 in (13 mm).
d. Hold the syringe at a 10- to 20-degree angle from the site and insert the needle about 0.5 in (13 mm).

10. A patient comes into the clinic to have a tuberculosis (TB) skin test read. What describes the accurate procedure for reading the TB test results?
a. Measure the width of the erythema.
b. Document the test as positive if induration or erythema is noted.
c. Measure the width of the induration.
d. Document the test as negative if no induration or erythema is noted.

11. The nurse is preparing an ID injection. Which supplies are most appropriate for this procedure?
a. a 27G, 0.5 in (13 mm) needle and a 1 mL hypodermic syringe
b. a 27G, 0.25 in (6.4 mm) needle and a 3 mL hypodermic syringe
c. a 27G needle and an insulin syringe
d. a 27G needle and a tuberculin syringe

12. The nurse is preparing to administer an ID injection. What is the appropriate procedure for administering ID injections?
a. Hold the syringe in the dominant hand between the thumb and forefinger, with the bevel of the needle up.
b. Hold the syringe in the nondominant hand between the thumb and forefinger, with the bevel of the needle up.
c. Hold the syringe in the dominant hand between the thumb and forefinger, with the bevel of the needle down.
d. Hold the syringe in the nondominant hand between the thumb and forefinger, with the bevel of the needle down.

13. A patient is scheduled to come into the clinic for intradermal allergy testing. What action taken by the nurse has the highest priority?
   a. Monitor the patient for a reaction.
   b. Premedicate the patient with diphenhydramine (Benadryl).
   c. Ensure the availability of an emergency medicine kit.
   d. Ensure there is a sharps container nearby.

14. The nurse is preparing to administer an SQ injection. What is the appropriate procedure for administering subcutaneous injections?
   a. Massage the injection site after administering the medication.
   b. Aspirate before injecting the medication into the adipose tissue.
   c. Use a 5/8 to 1 in (16 to 25.4 mm) needle, depending on the amount of adipose tissue present.
   d. Inject at a 45- or 90-degree angle depending on the amount of fatty tissue present.

15. The nurse is administering an SQ injection to a patient. Which anatomical site should the nurse use?
   a. front side of the upper arm
   b. abdomen from below the costal margin to the iliac crest no closer than 1 in (2.5 cm) to the umbilicus
   c. on top of the thigh
   d. lower ventral gluteal region

16. The nurse is preparing to administer SQ insulin to a patient. What is true regarding administering insulin?
   a. Rotate the injection sites within one anatomical area each day.
   b. Rotate the injection sites to different anatomical areas each day.
   c. Insulin is absorbed the fastest in the arm.
   d. Prepare the insulin in a 2 mL syringe with a 3/8 in (9.5 mm) needle.

17. Which syringe would *not* be appropriate for administering a subcutaneous injection?
   a. U-100 insulin syringe
   b. 3 mL hypodermic syringe
   c. 1 mL tuberculin syringe
   d. 1 mL hypodermic syringe

18. What complication can develop as a result of not rotating SQ injection sites?
   a. extensive bruising
   b. lipohypertrophy
   c. erythema
   d. septicemia

19. The nurse is administering an IM injection to a patient using the ventrogluteal site. How would the nurse locate the site?
   a. Place three fingers across the deltoid muscle and below the acromion process.
   b. Locate the area that is one hand's width below the greater trochanter and one hand's width above the knee.
   c. Place the palm on the greater trochanter and the index finger on the anterior superior iliac spine.
   d. Visually divide the buttocks into four quadrants and use the upper, outer quadrant.

20. The nurse is preparing to administer an IM injection to a patient. Which best describes the nurse's recommended hand movements?
   a. Move the dominant hand to steady the lower end of the barrel of the syringe and the nondominant hand to the end of the plunger.
   b. Move the nondominant hand to steady the needle and the dominant hand to the end of the plunger.
   c. Move the dominant hand to steady the needle and the nondominant hand to the end of the plunger.
   d. Move the nondominant hand to steady the lower end of the barrel of the syringe and the dominant hand

to the end of the plunger.

21. During the administration of an IM injection, the patient complains of radiating pain, burning, and tingling down the affected leg. What action should the nurse take?
   a. Stop the injection and remove the needle.
   b. Inject a little bit more of the medication to see if the symptoms continue.
   c. Ensure the patient that the symptoms will go away as soon as the injection is over.
   d. Reposition the extremity before continuing with the injection.

22. The nurse is preparing to administer a hepatitis A vaccine intramuscularly. What is the best practice for administering this vaccine by the IM route?
   a. Inject the vaccine into the deltoid site.
   b. Aspirate prior to injecting the vaccine.
   c. Multiple vaccines should not be given in the same extremity.
   d. Inject the vaccine into the ventrogluteal site.

23. Mr. Lopez came into the clinic to receive an annual influenza vaccine. The nurse prepares the medication and plans to administer the vaccine in the deltoid muscle. Which anatomical landmark should be used to ensure the injection is administered safely?
   a. greater trochanter
   b. acromion process
   c. iliac crest
   d. knee

Check Your Understanding Questions

1. Describe the process for administering oral medications.

2. What instructions should the nurse provide to the patient when administering medications via the sublingual or buccal route?

3. What are the five rights of delegating medication administration?

4. What is the maximum volume that can be injected intradermally, subcutaneously, and intramuscularly?

5. Explain which insulins may be mixed together and which may not.

6. What are the benefits associated with prefilled cartridges?

7. What is the appropriate needle gauge and length to use for an ID injection?

8. What is the appropriate needle gauge and length to use for an SQ injection?

9. Describe how to perform the Z-track method and why it may be used to administer IM medications.

10. The nurse is preparing to administer a hormonal medication by the IM route. What size needle (length and gauge) should the nurse use to administer the medication?

Reflection Questions

1. After administering medications, the patient takes a couple of pills prepared by the nurse, the patient's phone rings, and the patient asks the nurse to leave the cup of medications on the table, stating they will take them after they get off the phone. How should the nurse respond?

2. While opening the package, the medication falls on the floor. What should the nurse do?

3. Why would you want to crush medications one at a time while at the patient's bedside?

What Should the Nurse Do?

Mr. Hernandez is a 92-year-old male being treated for a severe decubitus ulcer. The patient has a history of

dysphagia and has a G tube placed in his abdomen. The nurse is preparing the patient's daily medications and notes the following medications in the patient's medication drawer:

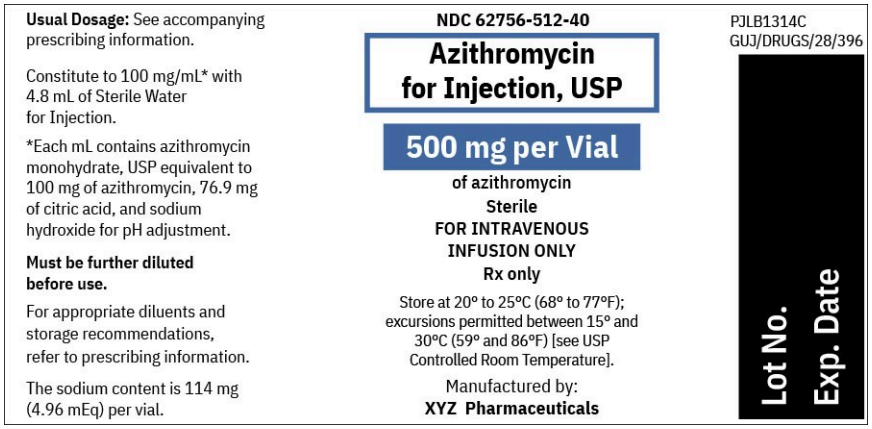
- sucralfate (Carafate) suspension
- acetaminophen (Tylenol) liquid
- nitroglycerin (Nitrostat) sublingual tablet
- pantoprazole (Protonix) enteric-coated tablet
- loratadine (Claritin) tablet
- metoprolol (Toprol-XL) extended-release tablet

1. What must the nurse consider when administering medications via a feeding tube?
2. Are the medications in the drawer safe to administer to the patient? If not, which medications should the nurse question?
3. How should the medications be prepared before administering them to the patient?
4. How should the nitroglycerin tablet be administered?

Mr. Barker is scheduled to receive furosemide and morphine, both IV, at 10 a.m. Provided both medications are ordered for the same time via the same route, the nurse considers mixing the medications into one syringe.

5. What should the nurse do before administering both medications in the same syringe?
6. How might the nurse check the compatibility of these medications?
7. What might happen if incompatible medications are mixed together in the same syringe?

Using the label for azithromycin shown here, answer the following questions:



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8. What diluent must be used for reconstitution?
9. How much of the diluent must be used to prepare the medication?
10. What is the final concentration of the prepared solution?
11. What is the final volume to be expected after reconstituting the medication?
12. If the order is for 250 mg of Zithromax, how many mL would the nurse administer?

Ms. Harrison comes into the clinic on Monday afternoon to receive a tuberculosis (TB) test for nursing school. The nurse prepares the purified protein derivative (PPD) using a tuberculin syringe.

13. What questions should the nurse ask Ms. Harrison before administering the TB test?
14. Where should the TB test be placed?
15. How would the nurse verify the test was performed correctly?
16. When should Ms. Harrison return to have the TB test read?
17. Ms. Harrison returns to the clinic on Friday to have the TB test read. What should the nurse do?

Competency-Based Assessments

1. Create a video demonstrating the process of administering oral medications.
2. Role-play the appropriate procedure for withdrawing medications from an ampule.

3. Create a video demonstrating proper technique for mixing insulins.
4. Role-play the proper procedure for administering ID injections.
5. Demonstrate the appropriate technique for administering SQ injections.
6. Create a video demonstrating proper administration of IM injections.
7. Review all the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 13

Intravenous Administration

FIGURE 13.1 A nurse performs an initiation of an intravenous peripheral line on a patient in the hospital. (credit: modification of "US Navy 060612-N-3714J-085 Navy Hospital Corpsman Vicente Mendes, of Brooklyn, N.Y., prepares a patient for an IV before having surgery.jpg" by U.S. Navy/Wikimedia Commons, Public Domain)

CHAPTER OUTLINE

13.1 Principles of Intravenous Therapy
13.2 Intravenous Device Insertion
13.3 Intravenous Infusion
13.4 Blood Transfusions

INTRODUCTION The purpose of intravenous (IV) therapy is to replace fluid and electrolytes, provide medications, and replenish blood volume. Intravenous therapies are introduced directly into the bloodstream, and the nurse plays a critical role in ensuring that IV medications are administered safely. Specifically, the nurse's responsibility in managing IV therapy includes selecting an IV site, inserting the IV, routinely assessing the IV site, preparing the IV tubing, calculating the correct rate for the infusion, administering IV treatment, monitoring the effectiveness of the IV therapy, and documenting the infusion.

13.1 Principles of Intravenous Therapy

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify indications for using the intravenous route
- Recognize and understand how to comply with safety considerations when using the intravenous route
- Describe common medications given intravenously

In intravenous (IV) therapy, fluids and medications are administered directly into the vein. One of the most used types of IV is a **peripheral intravenous (PIV) line** in which a small plastic catheter is inserted into a peripheral vein,

usually in the hand, arm, or forearm. There are several situations that indicate use of IV administration because of its fast onset of action and ability to bypass the digestive system. While IV therapies can provide great benefit, there are also important safety considerations, including potential mild to severe complications. This section discusses the basic principles of IV therapy, including indications for use, safety considerations, and medications commonly administered via the IV route.

Indications for Using the Intravenous Route

Intravenous therapy involves the administration of substances, such as fluids, electrolytes, blood products, nutrition, or medications directly into a patient's vein. The IV route works best to administer fluid and medications quickly. Directly administering medication into the bloodstream allows for a more rapid onset of medication actions, restoration of hydration, and correction of nutritional deficits and electrolyte balances more quickly than the oral route.

Rapid Onset of Medication Action

The IV route is preferable for administering many medications when the patient's condition necessitates rapid onset. For example, many types of pain medications can be infused directly into the bloodstream, and the patient will receive relief in minutes rather than hours for peak relief if they were administered orally. Rapid onset through IV administration is also critical to treat cardiac emergencies or severe allergic reactions to quickly restore patients to optimal body functioning. Each IV medication has its own safe rate of infusion, which is specified by the drug's manufacturer (Infusion Nurses Society [INS], 2024; Institute for Safe Medication Practices, 2015).

Precise Control Over Dosage

The IV route of medication administration provides precise control over medication dosages. Because medications administered via the IV route bypass the gastrointestinal system, patients absorb 100 percent of the drug into their bloodstreams.

Intravenous push medications work for short-term dosing of medications. In **short-term dosing**, a specific medication is prescribed for a relatively brief duration. In contrast, long-term or chronic medication use typically involves taking a medication over an extended period, often for the management of a chronic condition or as part of ongoing preventive care. Medications administered via **IV push** are manually injected into the IV line. They are typically administered slowly, ranging from minutes to seconds, and have a fast-acting therapeutic effect. Intravenous push medications can be prescribed as needed or can be prescribed on a schedule.

A **continuous infusion** is constantly delivered over an extended period of time, from hours to days, while an **intermittent infusion** is delivered at a specific interval or scheduled time. Continuous infusions maintain drugs with a narrow therapeutic window to eliminate fluctuations between peak and trough concentrations. One of the main advantages of administering a medication by continuous IV infusion is that nurses and healthcare providers can tailor drug concentrations to meet the needs of each patient. For example, the difference between a therapeutic dose of heparin and a dose that can lead to serious bleeding is relatively small. Therefore, IV heparin is administered via continuous IV infusion to allow for close monitoring and careful dosage adjustment to ensure that the patient receives the appropriate level of anticoagulation while minimizing the risk of bleeding or clotting complications.

Restore and Maintain Fluid and Electrolyte Balance

Maintaining fluid and electrolyte balance is critical for cell functioning. Administering IV fluids quickly and efficiently restores fluid imbalances and helps maintain proper fluid levels and electrolytes. Nurses often administer IV fluids to correct deficits in fluid volume, such as dehydration. They may also be administered to move fluids in and out of intracellular and intravascular spaces. Intravenous fluids also can replace electrolytes, such as potassium, calcium, and magnesium.

Nutrition (Parenteral Nutrition)

An IV can also administer **parenteral nutrition (PN)**. When the patient is unable to meet their dietary needs through regular digestion, whether it be malfunctioning of the gastrointestinal system or the patient's inability to tolerate foods and fluids for a long period of time, parenteral nutrition is warranted.

There are two types of parenteral nutrition: **peripheral parenteral nutrition (PPN)**, which is typically used for

nutritional supplementation in combination with other nutritional sources; and **total parenteral nutrition (TPN)**, which is used for total replacement of dietary needs. Administration of PPN is via a peripheral IV, and TPN is administered via a **central venous access**, or central line, where the IV is inserted in or near a large vein that goes into the superior vena cava. While PPN and TPN both deliver nutrients and calories, PPN is typically made up of a diluted formula with fewer calories, and TPN is a denser formula with more calories. Peripheral parenteral nutrition is only appropriate for short-term therapy, while TPN may be used for more long-term or permanent therapy.

Safety Considerations when Using Intravenous Route

When administering IV therapies, nurses should comply with safety precautions to reduce the risk of potential complications. These complications may be local or systemic and include infection, damage to the vein and surrounding tissue, air emboli, blood clots, and fluid overload. The nurse plays a key role in monitoring for signs of complications, initiating safety interventions to reduce the risk and severity of complications, and performing routine assessments of the IV. For example, replacing electrolytes such as sodium, potassium, or magnesium via the IV route is faster than the oral route; however, the nurse must be mindful of giving the correct amounts of electrolytes and maintaining therapeutic levels. The nurse will monitor the patient's sodium and potassium levels, through blood tests, as well as assess the patient for symptoms of overdose or toxicity.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Monitoring an IV Site and Infusion

See the competency checklist for Monitoring an IV Site and Infusion. You can find the checklists on the Student resources tab of your book page on openstax.org.

Infection

Redness, tenderness, swelling, and purulent drainage from the IV site can indicate local site infection. If you suspect a local infection, remove the IV and notify the provider (INS, 2024). Monitor blood work and all vital signs, which may identify a systemic infection. While identifying the signs and symptoms of infection are necessary, a prudent nurse will take steps to prevent infection during the IV process. The nurse will ensure that all equipment is sterile with intact packaging and the site is cleaned with alcohol or another accepted agent per facility policy. The nurse will wear gloves and use proper technique to insert and properly secure the IV, label it appropriately, and inspect it daily for signs of infection (INS, 2024). The nurse will provide ongoing education to the patient and caregivers about IV site care and when to notify the nurse of any changes.

Damage to the Vein and Surrounding Tissue

Damage to the vein and surrounding tissue may be caused by infiltration, extravasation, or phlebitis. In the event these complications occur, stop the IV fluids immediately, and remove the IV. Notify the provider and implement appropriate nursing interventions to ease symptoms. If the patient needs ongoing vascular access, restart the IV in an alternate area (INS, 2024). Collaborate with the provider about the benefits of a slower infusion rate, different medication, or further dilution to prevent reoccurrence (INS, 2024).

An infiltration occurs when the tip of the catheter slips out of the vein allowing fluid to infuse into the surrounding tissue, instead of through the vein (Figure 13.2). Infiltration may cause pain, swelling, and skin that is cool to the touch. If infiltration occurs, the nurse should remove the IV and assess it to make sure it is intact, then follow agency protocols. This may include applying a warm or cold compress, elevating the limb, or other approved treatments per facility policy (INS, 2024).

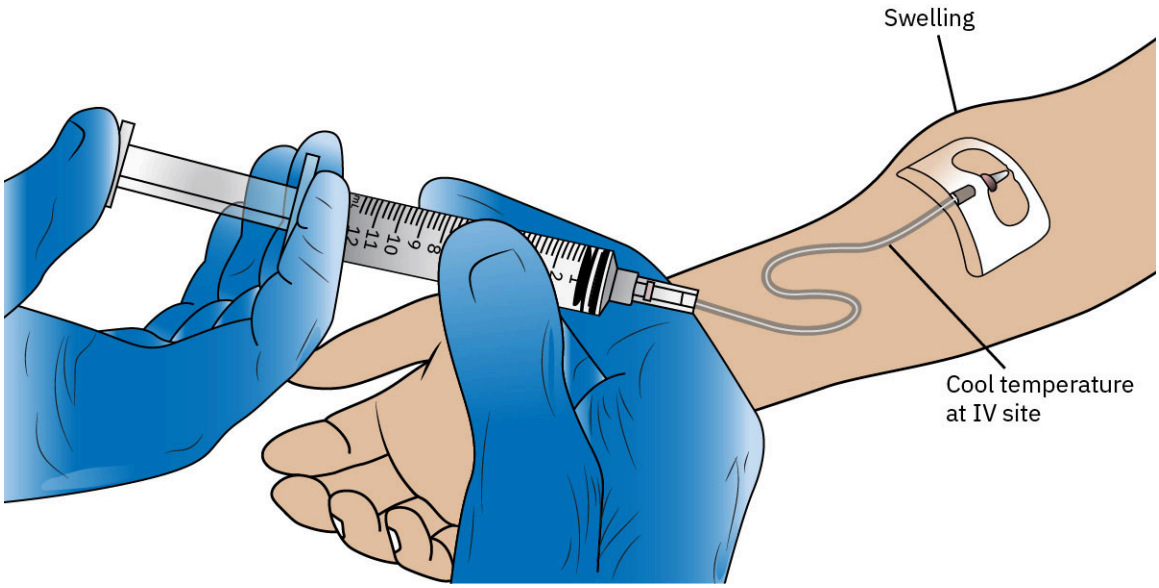


FIGURE 13.2 Intravenous infiltration causes swelling around the site. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

An **extravasation** refers to infiltration of damaging IV medications, such as chemotherapy, into the extravascular tissue around the site of infusion. Extravasation causes tissue injury, and depending on the medication, site, and length of exposure, it can cause tissue death, which is referred to as **necrosis** (Figure 13.3). Common symptoms and signs of extravasation include pain, stinging or burning sensations, blisters, and edema around the IV injection site. If extravasation occurs, the nurse should remove the IV and assess it to make sure it is intact, then follow agency protocols. This may include applying a warm or cold compress, elevating the limb, or other approved treatments. Avoid using the affected limb for vascular access until extravasation has resolved (INS, 2024). If detected early, extravasation may be treated with medications that help avoid the complication of necrosis.

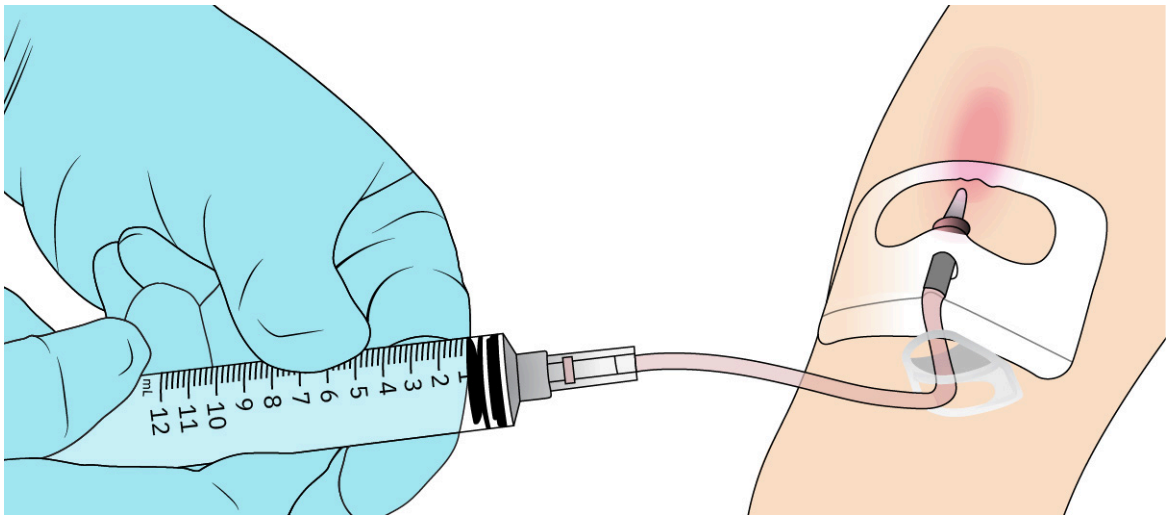


FIGURE 13.3 Extravasation can be painful and cause edema around the IV injection site. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

REAL RN STORIES

Extravasation Leading to Long-Term Scarring

Name: Diane, RN
Clinical setting: Neonatal intensive care unit
Years in practice: 8

Facility location: Jackson, Mississippi

It was August 2014, and I was caring for a young male, Cole, who was born eight weeks prematurely. Cole was receiving IV vancomycin for a staphylococci infection. I began the IV vancomycin infusion in the IV located in Cole's right hand. Concerned about the IV dislodging, I wrapped the IV site in gauze to stabilize the tubing. Several hours later when I unwrapped the IV to give Cole a bath, I noticed the IV had infiltrated and caused extravasation in the tissue surrounding the IV site. I immediately removed the IV and initiated a new IV site. The extravasation of the fluids caused tissue injury that resulted in a scab formation. Nine years later, Cole still has permanent scarring to his right hand as a result of the extravasation (Figure 13.4). Had I not wrapped the IV site and assessed it more frequently, I probably would have caught the infiltration earlier and avoided the permanent tissue injury.

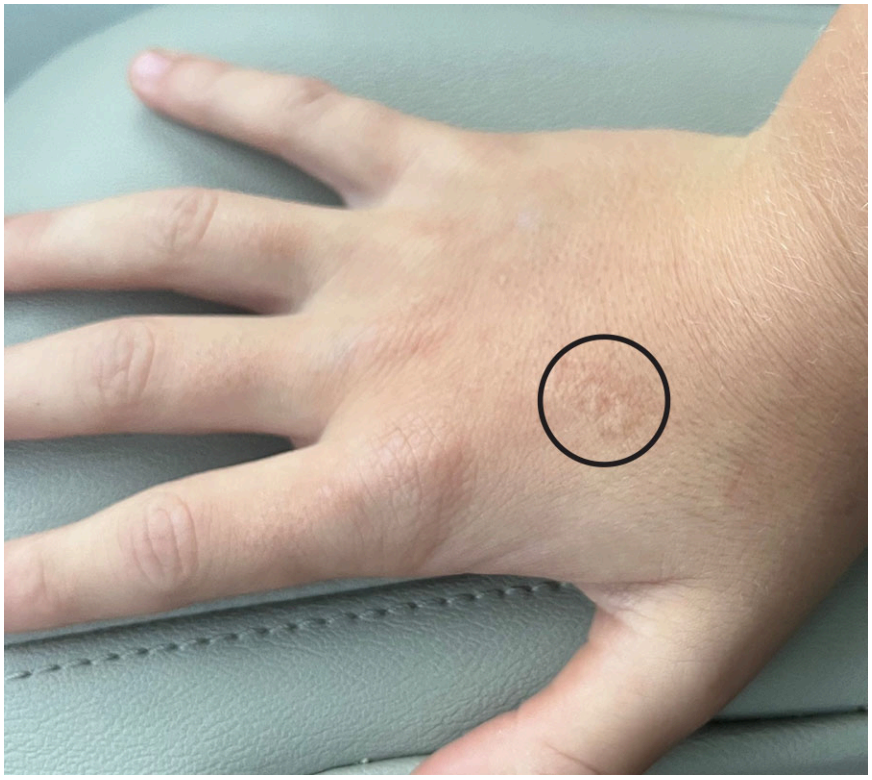


FIGURE 13.4 Extravasation can cause permanent scarring. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Inflammation of a vein is termed **phlebitis** and can be caused by chemical factors, mechanical factors, or infectious factors (INS, 2024). A reaction to irritating infusions or medications can cause chemical phlebitis. Factors such as catheter insertion angle, constant flexion at the catheter site, inadequate securement, large catheter size, and insertion trauma can cause mechanical phlebitis. Infectious phlebitis is caused by bacterial contamination. Phlebitis causes redness and tenderness along the vein (Figure 13.5). Treatment includes warm compresses, elevation, nonsteroidal anti-inflammatory medications, and antibiotics (INS, 2024).

FIGURE 13.5 Phlebitis is characterized by redness along the vein. (credit: "1345" by Sellers/CDC, Public Domain)

Air Emboli

An **air embolus** occurs when air or gas makes its way into the vascular system. A venous air embolus will travel to the right ventricle and/or pulmonary system. An arterial air embolus travels until it becomes trapped somewhere in the arterial system. While most patients typically tolerate small air bubbles, over 10 mL of air may have serious side effects, including death. Symptoms of an air embolism include the following:

- sudden shortness of breath
- coughing
- breathlessness
- wheezing
- shoulder or neck pain
- lightheadedness
- increased heart rate
- hypotension
- altered mental status
- jugular vein distension
- agitation and/or feelings of impending doom

If you suspect an air embolus, occlude, or close off, the source of air entry by engaging the roller clamp on the tubing, place the patient in Trendelenburg (with the head lower than the rest of the body and the legs elevated) on the left side, apply 100 percent oxygen, obtain vital signs, and notify the provider immediately (INS, 2024). To prevent air emboli, ensure that the drip chamber (the portion of IV tubing located just below the IV bag that controls the flow rate of the fluid) is one-third to one-half full, confirm tight security in all IV connections, and properly remove all air from the IV tubing when priming the line (INS, 2024).

Catheter-Associated Thrombosis

A **catheter-associated thrombus** is an inflammatory response to an IV catheter that causes a blood clot to form and block one or more veins. When the blood clot involves superficial veins of the arms or legs, it is known as **superficial vein thrombosis (SVT)**. An SVT is not usually a serious medical emergency, but it should be treated to prevent the clot from becoming bigger. If an SVT becomes bigger, it may develop into a **deep vein thrombosis (DVT)**, defined as a blood clot that forms in a deep vein of the arm or leg.

Patients with a history of obesity, diabetes, thrombophilia, cancer, a family history of thrombosis, or receiving IV chemotherapy are at highest risk for developing a catheter-associated thrombus (INS, 2024). Blood clots are typically diagnosed by Doppler or ultrasound study and treated with anticoagulants. Patients with catheter-related blood clots should be carefully monitored for more severe symptoms, such as shortness of breath, low oxygen saturation, tachycardia, hypotension, and chest pain, which may indicate that the blood clot has broken off the

catheter and traveled to the heart or lungs, causing a pulmonary embolism.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Intervening in a Suspected IV Complication

The nurse is caring for a patient receiving continuous IV fluids by gravity. The patient calls the nurse into the room complaining of shortness of breath, lightheadedness, and feelings of impending doom. Upon further assessment, the nurse notes that the patient is experiencing an increased heart rate, hypotension, altered mental status, jugular vein distension, and agitation. The nurse analyzes the cues to determine that the patient may be experiencing an IV complication. According to the symptoms present, the nurse hypothesizes that the patient may be experiencing a pulmonary embolism related to a catheter-associated blood clot or an air embolism. Upon assessing the IV tubing, the nurse notes the IV bag is empty, and the IV line is filled with air. The nurse concludes that the air in the IV tubing most likely caused the patient to experience an air embolism. The nurse immediately clamps the IV tubing to occlude the source of air entry, places the patient in Trendelenburg on the left side, applies 100 percent oxygen, obtains vital signs, and notifies the provider.

Due to the safety risks with administering IV fluids by gravity, it is preferable to administer IV fluids using an IV pump, as IV pumps contain sensors that would identify the air in the IV line before it reaches the patient. However, there may be some situations and agencies in which an IV pump may not be available. In these situations, it is imperative to closely monitor the IV fluid levels to ensure patient safety.

Fluid Overload

Excessive fluid volume (also referred to as **fluid overload**) occurs when there is increased fluid retained in the intravascular compartment. Patients at risk for developing excessive fluid volume are those with the following conditions:

- heart failure
- kidney failure
- cirrhosis
- pregnancy

Symptoms of fluid overload include pitting edema ascites, and dyspnea and crackles from fluid in the lungs. Edema is swelling in dependent tissues due to fluid accumulation in the interstitial spaces (Figure 13.6). Ascites is fluid retained in the abdomen.

Treatment depends on the cause of the fluid retention. Sodium and fluids are typically restricted, and diuretics are often prescribed to eliminate the excess fluid. The nurse must acknowledge the importance of monitoring intake and output levels to help avoid or monitor this situation.

FIGURE 13.6 Edema can be caused by fluid overload. (credit: "Edema Hands 01.jpg" by Wang Kai-feng, Pan Hong-ming, Lou Hai-zhou, Shen Li-rong, Zhu Xi-yan/Wikimedia Commons, CC BY 2.0)

Common Medications Administered Intravenously

Intravenous medications are often used when providers want greater control over bioavailability (medication speed of action) and dosing. Other medications must be administered via IV because they are poorly absorbed by the digestive tract or are destroyed by digestive enzymes. Examples of medications that may be administered by IV include antibiotics, pain medications, emergency medications, chemotherapy, and immunoglobulins (IV immunoglobulin (IVIG)).

Antibiotics

Intravenous antibiotics are generally used to treat bacterial infections in the lungs, heart, bones, soft tissue, and brain. They are also used for severe infections, like sepsis, because IV antibiotics reach the tissues faster and at higher concentrations than oral antibiotics. Intravenous antibiotics may also be warranted when oral antibiotics are less likely to reach the infection, such as infection in the spinal fluid and bone, or when the infection is resistant to oral antibiotics. Examples of antibiotics commonly administered via the IV route include ampicillin, cefazolin, cefepime, vancomycin, and piperacillin.

Pain Medications

Pain medications may be administered via the IV route when pain is severe or uncontrolled by oral medications. Intravenous pain medications may also be ordered when the patient cannot take oral medications. For example, they have an order for nothing by mouth (NPO), are not awake enough to swallow, or are at a high risk for choking. Two examples of IV pain medication classifications are nonsteroidal anti-inflammatory drugs (NSAIDs) and opioid-based narcotics. Examples of NSAID pain medications commonly administered via the IV route include ketorolac (Toradol), and ibuprofen (Caldolor). Examples of opioid-based narcotics administered via the IV route include fentanyl, hydromorphone, and morphine.

Emergency Medications

Due to the rapid onset, the IV route is often the preferred method for administering emergency medications. For example, plasminogen activator (tPA) and alteplase are administered via the IV route to treat strokes. Intravenous morphine may be administered to treat angina pain that is unresponsive to nitroglycerin. In the hospital setting,

naloxone is administered via IV to reverse opioid overdoses, and flumazenil is used to treat benzodiazepine overdoses. Intravenous lorazepam or midazolam is used to treat status epilepticus. Atropine, epinephrine, and dopamine may be administered to treat bradycardia. Adenosine, diltiazem, atenolol, and amiodarone may be administered to treat tachycardia.

Chemotherapy

Intravenous chemotherapy is often required for treatment of cancer. Because chemotherapy drugs are **vesicant**s, drugs that can cause blisters or tissue necrosis if leaked into the surrounding tissue, they are typically administered via a central venous catheter (CVC). Administering chemotherapy via a CVC reduces the risk of extravasation, reduces the number of times the patient must be stuck with a needle, and ensures reliable IV access for administering the drug.

Intravenous Immunoglobulin

Human antibodies administered to help fight certain infections are termed **IV immunoglobulin (IVIG)**. Intravenous immunoglobulin may be required when the body does not make enough antibodies or if a patient has an autoimmune disease where the immune system attacks their own body, such as myasthenia gravis, Guillain-Barré syndrome, Kawasaki disease, and lupus. Side effects of IVIG include headache, fever, chills, flushing, flu-like aches, fatigue, nausea, vomiting, and rash. More serious side effects, while rare, include allergic reactions, anemia, and contracting disease through the human antibodies that were donated by others, such as HIV, hepatitis B, and hepatitis C.

13.2 Intravenous Device Insertion

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify common types of vascular access devices used for IV medication administration
- Recall equipment needed for IV device insertion
- Analyze principles for peripheral intravenous catheter site selection

To administer IV medications, providers must insert an IV device into the patient's vein. There are several types of vascular access devices used for administering IV medications, each with their own indications for use and protocols for care. The nurse must have a clear understanding of the various types of vascular access devices to be able to safely administer medications via the IV route. This means having a clear understanding of the needle size, cannula type, and site location to determine if the site is appropriate for the medication. The nurse must also gather all necessary supplies needed to administer the IV medications prior to insertion.

Types of Vascular Access Devices

A **vascular access device** is a thin, flexible catheter that provides access to blood vessels without the need for repeated needlesticks. There are three main types of vascular access devices: peripheral intravenous catheters (PIVCs), midline catheters, and CVCs. The type of access device used depends on several factors, including the duration of IV therapy, type of IV solution to be administered, vein condition, as well as the patient's condition (Figure 13.7).

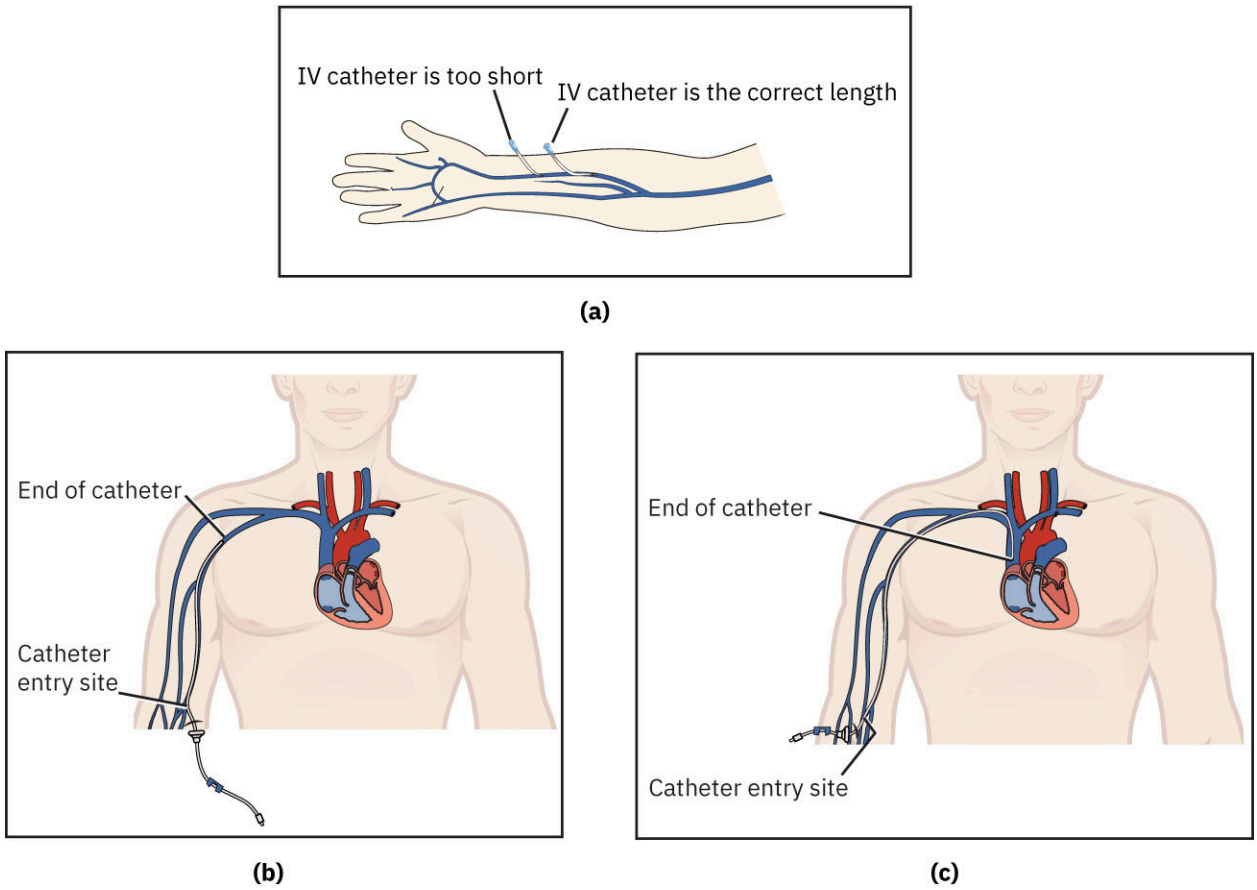


FIGURE 13.7 When choosing a peripheral IV location, the nurse must take into consideration the (a) length of the catheter. Providers must also choose sites wisely when inserting (b) midline catheters and (c) central venous catheters. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Peripheral Intravenous Catheters

A **peripheral intravenous catheter (PIVC)** is the most common type of IV. The nurse typically places this type of IV in either the arm or hand. A single-lumen catheter, usually between ¾ and 1 in (1.9 and 2.5 cm) long, is inserted into the patient's vein. A **catheter** is a small hollow tube placed in the vein. A **lumen** is a tube that comes out of the skin and is used to administer medications. An IV may be single lumen (one tube), double lumen (two tubes), or triple lumen (three tubes). A PIVC line usually uses a single-lumen catheter. A PIVC is usually used when treatment is only for a few days, the solution is not irritating to peripheral veins, the patient has healthy looking veins, and the peripheral circulation is normal (INS, 2024). Patients who have poor peripheral circulation, might need long-term therapy (weeks to months), and have weak or thin veins are not suitable candidates for PIVCs. Additionally, if the solution being administered has a high dextrose content or is corrosive to veins, a PIVC is not appropriate.

Midline Catheters

A **midline catheter** is inserted into a peripheral vein located slightly below the elbow. Midline catheters are typically 3 to 10 in (7.6 to 25.4 cm) long; they are shorter than central lines and do not go all the way to the superior vena cava. They may be a better choice than peripheral IVs for patients who have fragile veins or require IV therapies for days to weeks. They can remain in place for fourteen days or longer, depending on the patient situation (INS, 2024). Midline catheters pose less risk of infection than CVCs. Nevertheless, nurses cannot use midline catheters to administer total parenteral nutrition (TPN) or medications that are known to damage the vein, as veins appropriate for midline catheters are deeper than those for PIVCs, and signs of extravasation cannot be seen until the damage is severe.

Central Venous Catheters

A **central venous catheter (CVC)**—also known as a central venous access device or central line—inserts into or near a large vein that goes into the superior vena cava via an incision to the neck (jugular vein), chest (subclavian vein), or groin (femoral vein). A CVC may be the optimal choice when the patient is critically ill; has fragile, damaged, or

difficult-to-locate veins; does not have an arm that can be used for IVs; necessitates a longer duration of IV therapy; needs TPN; or requires medications that may cause skin damage if leaked into the peripheral tissue. Benefits of CVCs include fewer needlesticks—meaning less pain and discomfort for the patient, reduced risk of complications such as infection, faster treatment, and decreased damage to the veins—plus the ability to infuse several medications at once, less risk of tissue damage, and ability to receive IV therapies at home.

While there are several benefits, there are also some risks associated with having a central line. The risks are similar to those for PIVCs and midline catheters, such as pain, bleeding, infection, blockage, blood clots, and migration or kinking; however, additional risks of CVCs include air embolisms, accidental removal resulting in hemorrhage, and a collapsed lung during central line placement. Patients who have a central line are at risk for developing a central line–associated bloodstream infection (CLABSI). A CLABSI is a preventable and potentially life-threatening infection that occurs when bacteria or other pathogens enter the bloodstream through a CVC. The infection can occur due to contamination of the catheter during insertion, improper maintenance and care, or secondary infections that spread from another site in the body. Symptoms of CLABSI can include fever, chills, increased heart rate, and, in severe cases, signs of sepsis such as hypotension (low blood pressure) and altered mental status. Diagnosis typically involves blood cultures to identify the causative pathogen. If a patient with a central line develops fever or other signs of infection, blood cultures are taken from both the central line and peripheral veins to determine whether the central line is the source of infection. Treatment involves administering appropriate antibiotics to target the specific pathogen causing the infection. The central line may need to be removed if it is suspected or confirmed to be the source of the infection. Key strategies for prevention include proper hand hygiene before touching the CVC lines or site, sterile techniques during central line insertion, regular maintenance, and care of the central line (including dressing changes using aseptic techniques), daily assessment of the need for the central line and prompt removal when it is no longer needed, and continuous education and training for healthcare providers on infection prevention measures.

There are several types of CVCs, including peripherally inserted central catheters (PICCs), tunneled central venous catheter (CVC)s, nontunneled percutaneous central venous catheters, and implanted ports.

Peripherally Inserted Central Catheter

A **peripherally inserted central catheter (PICC)** is placed into a vein in the arm, typically the cephalic or basilic vein, and passed through a vein that leads to the superior vena cava (Figure 13.8). The tip of the catheter protrudes from the arm; therefore, the patient must cover the arm with plastic while bathing because the catheter cannot get wet. Flush PICC lines before and after each use, as well as occasionally to keep the line open. A PICC may have one to three lumens to allow for more than one medication to be administered at a time. A PICC is commonly used for extended courses of IV antibiotics, chemotherapy, and total parenteral nutrition (TPN) and for patients with limited peripheral venous access. The PICC can be left in place for days to months and then removed when no longer medically necessary. A PICC is often preferred over other types of CVCs as it may be used for long-term IV treatment, is less invasive and more comfortable for the patient than tunneled and nontunneled CVCs, and does not restrict patient movement.

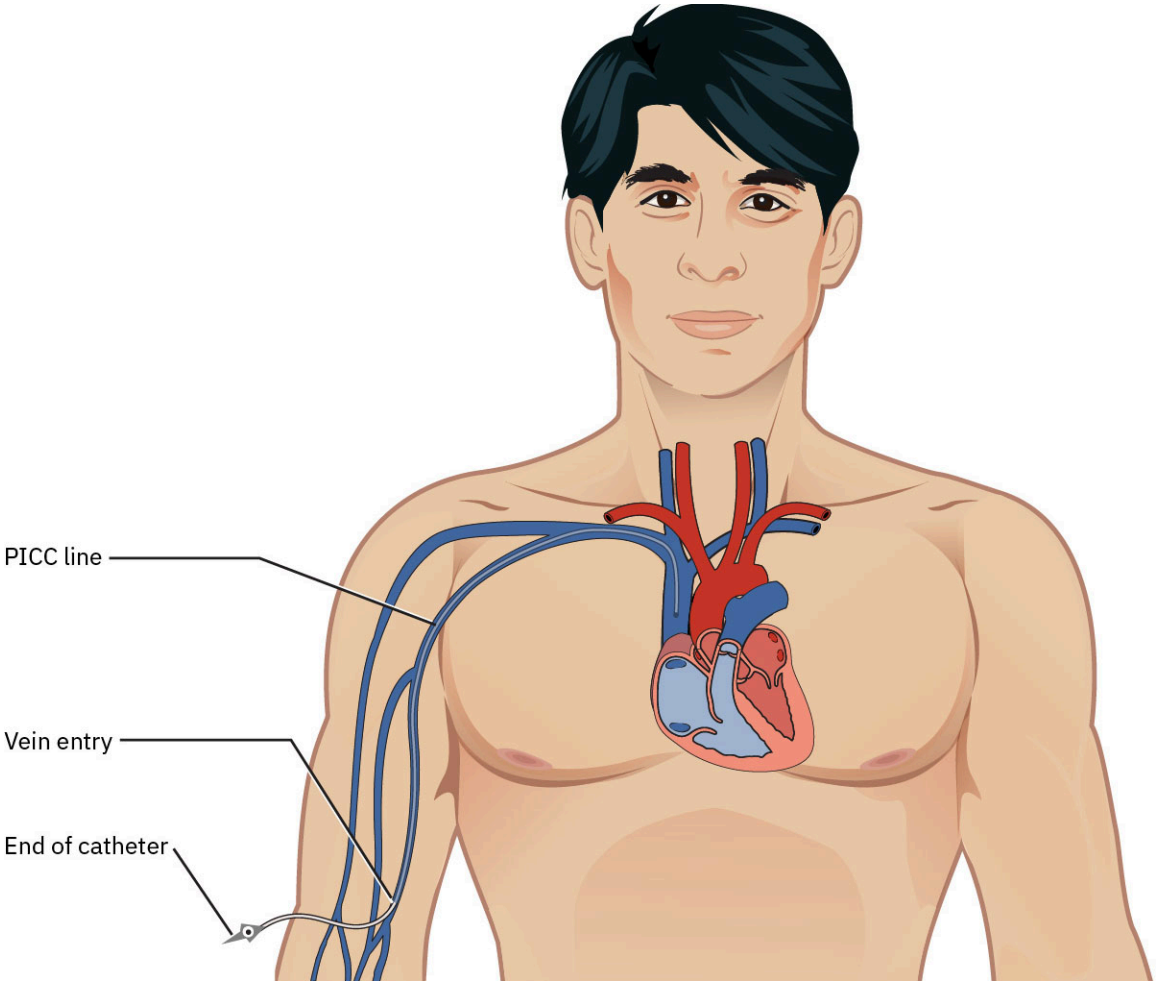


FIGURE 13.8 The catheter of a PICC line should enter the vein in the arm and extend into the superior vena cava. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Tunneled Central Venous Catheters

A **tunneled central venous catheter**, also known as Hickman or Permacath, inserts into a vein in the chest or neck, tunnels under the skin, and then comes out through a separate incision site where a cuff is wrapped around the catheter to hold it in place (Figure 13.9). Using this type of catheter reduces the risk of infection as well as the risk of accidentally pulling the line out of place. Because they are typically inserted in a controlled, sterile operating room or interventional radiology suite, the tunneling technique creates a barrier to help prevent external contaminants from entering the bloodstream, and the cuff helps to hold the catheter in place. Because the end of the catheter protrudes from the skin, this type of central line cannot get wet and must be covered with plastic while bathing or showering. Flush CVC lines before and after each use as well as occasionally to keep the line open. Tunneled CVCs may have one to three lumens to allow for multiple medications to be administered at the same time. Tunneled CVCs can be left in place for weeks to months and then removed when no longer medically necessary. Tunneled CVCs are typically chosen when long-term central venous access is required (often for several months to years) to administer long-term antibiotics, chemotherapy, or hemodialysis, as they are durable and designed for extended use.

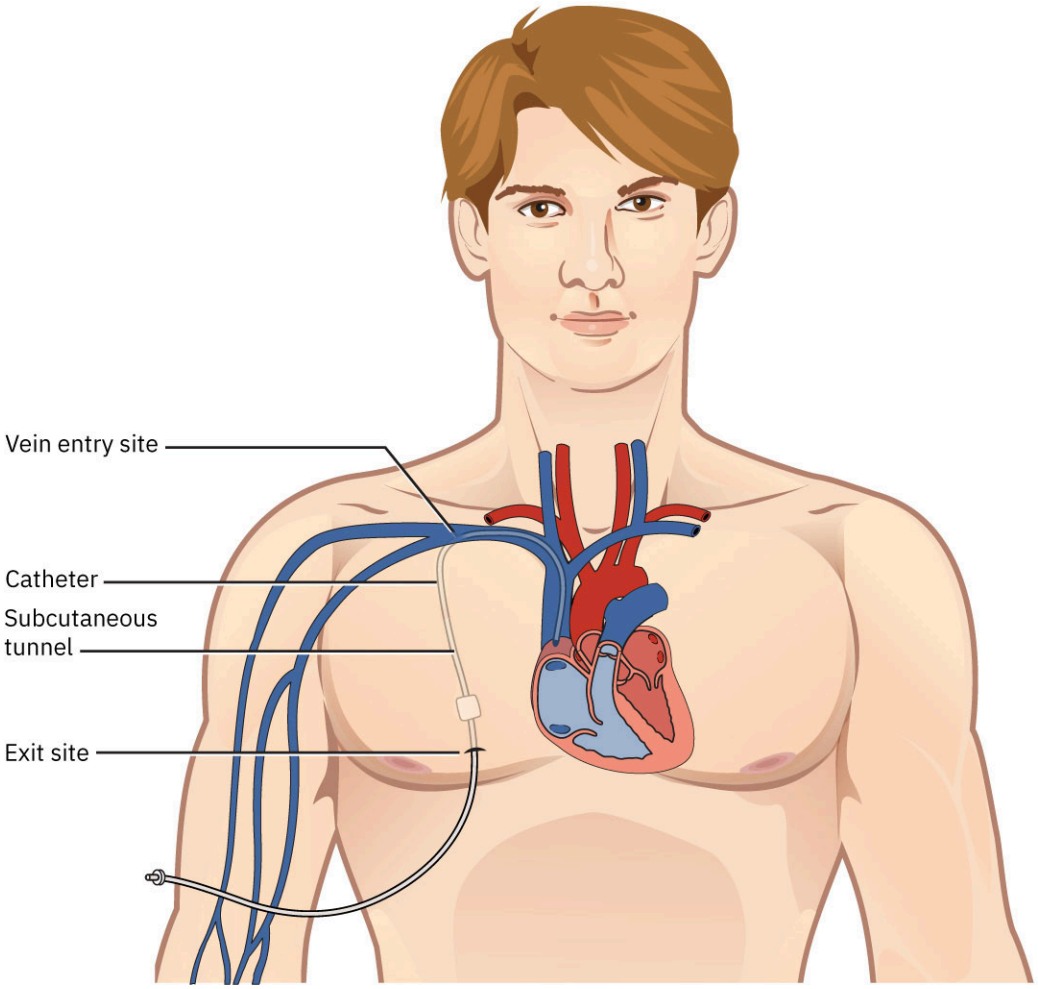


FIGURE 13.9 A tunneled central line is tunneled under the skin to create a more secure placement for longer duration and decreased chance for infection. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Nontunneled Percutaneous Central Venous Catheters

A **nontunneled percutaneous central venous catheter** is placed into a large vein near the neck, chest, or groin (Figure 13.10). Unlike tunneled CVCs, nontunneled lines are not placed with a tract under the skin, nor do they have a cuff to hold them in place. Nontunneled central lines are typically used for temporary venous access, such as in emergent situations and/or when a patient requires quick delivery of medications and fluids. Additionally, they are suitable for central venous pressure monitoring and in emergent situations where quick access is crucial, as they can be inserted more rapidly and easily than PIVCs, midlines, or other CVCs. Moreover, they are preferred when patients have limited peripheral veins and other options such as PIVCs, midlines, or PICCs are not feasible.

Nontunneled CVCs pose a higher risk of infection and potential dislodgement compared to other types, as they lack a cuff to secure them in place. To reduce the risk for CLABSI, it is recommended that nontunneled CVCs that were placed in emergent situations are removed within forty-eight hours after insertion (INS, 2024). The interdisciplinary team should also evaluate the need for the nontunneled CVC daily, and remove it as soon as it is no longer needed (INS, 2024).

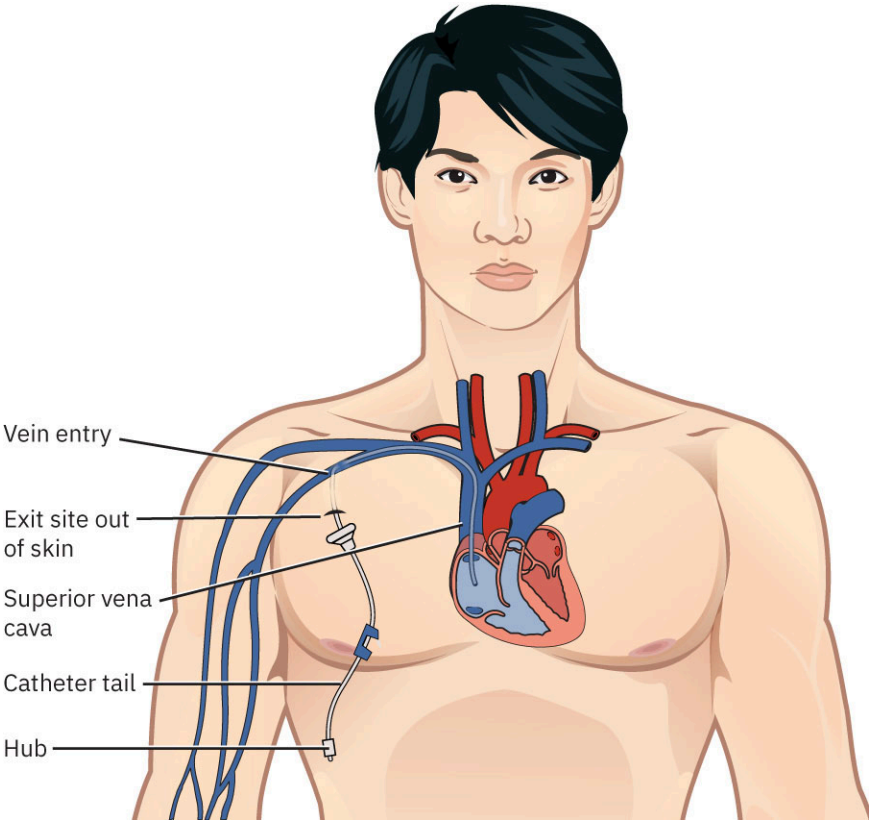


FIGURE 13.10 A nontunneled central line may be placed for short-term or emergent care, when other means of access are not available or appropriate. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Implanted Ports

An **implanted port**, also referred to as a Mediport or port-a-cath, is surgically placed under the skin. Although usually inserted in the upper chest, implanted ports may also be placed in the arm or abdomen (Figure 13.11). Implanted ports consist of three parts: the port, the septum, and the catheter. The port is a small, round, or oval chamber that is implanted under the skin. The septum is a self-sealing, rubber-like membrane located within the port body. To access the port, a specialized needle (called a Huber needle) punctures the septum to access the reservoir. After accessing the port, the septum self-seals when the needle is removed, preventing leaks or infections. The catheter is a thin, flexible tube that connects to the port on one end, and the other end sits in the vein.

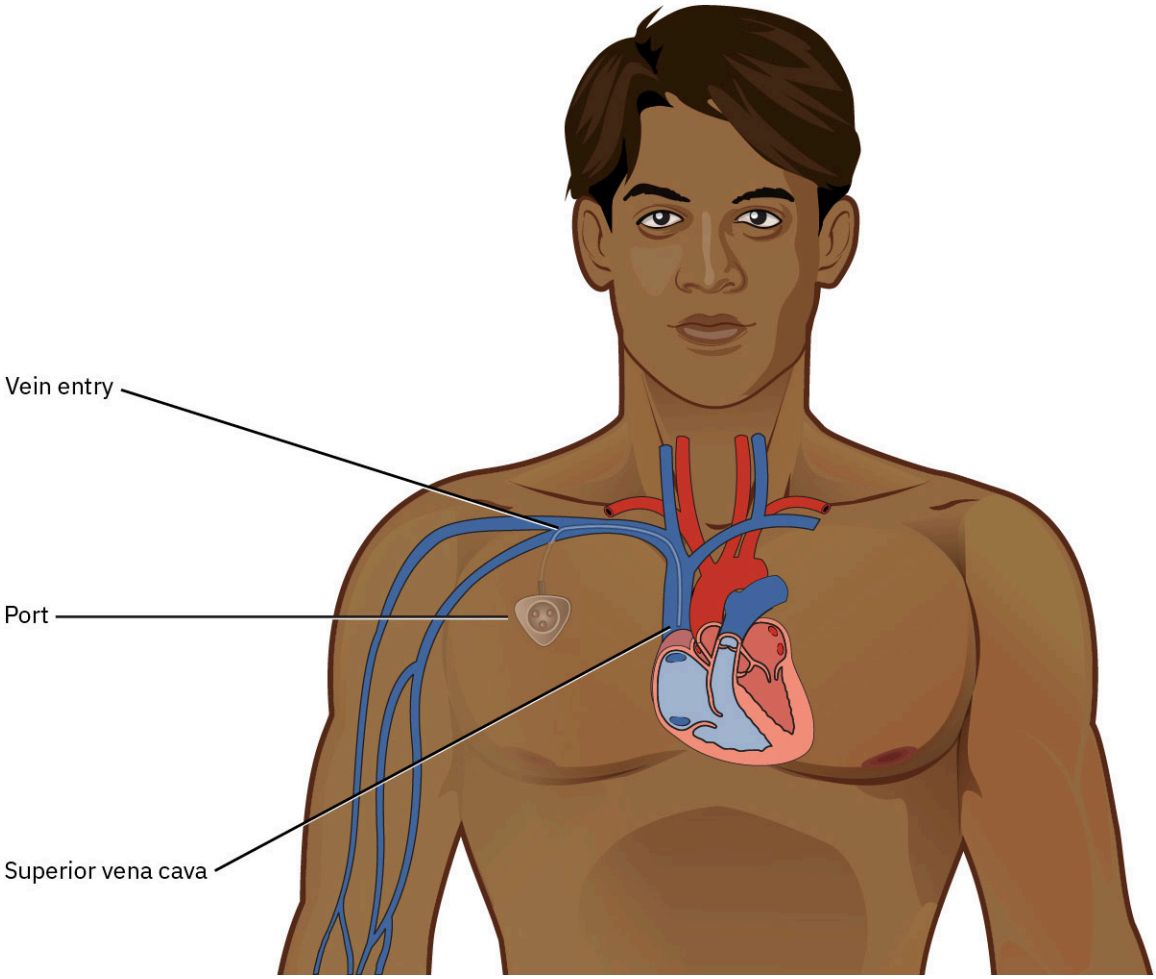


FIGURE 13.11 An implanted port is ideal central line access for long-term use, especially in patients receiving chemotherapy. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

When a patient has an implanted port, the nurse will access the port by placing a Huber needle through the skin and into the septum of the port. This process is called cannulation. The nurse then connects the port needle to the IV tubing to administer the IV therapies. Patients with implanted ports can shower and bathe if they cover port access in plastic to prevent the site from getting wet. Ports require flushing before and after each use as well as occasionally to keep the line maintaining patency. Once the IV therapy is complete, the needle is removed from the port until IV therapy is needed again.

Implanted ports are desirable for long-term use and can remain in place for months to years. Ports have a decreased risk of infection (as compared to PICCs and other CVCs) since the port is completely beneath the skin when it is not in use. They are also more discreet than external catheters, and patients can wear regular clothing over the port. As such, ports can be a great choice for patients who require intermittent long-term chemotherapy or antibiotics, frequent blood draws, or radiation. The downside to ports is that they result in scarring where the port was implanted, as well as it results in some initial discomfort and discomfort each time it is accessed.

Equipment Needed for Intravenous Insertion

When preparing to insert an IV, the nurse must prepare the necessary equipment prior to insertion. The equipment includes an IV start kit (Figure 13.12) with a tourniquet; antiseptic to cleanse the skin prior to insertion; several pieces of gauze; tape; transparent dressing; and a sticker to label the IV site with the nurse's initials, date and time of insertion, and gauge of the IV needle. The nurse will also need an appropriate IV needle, extension tubing or positive pressure cap to place on the end of the IV cannula, a normal saline flush to check for patency of the line, and tape to secure the IV tubing. If the patient is receiving continuous or intermittent IV therapies, the nurse will also need the appropriate IV tubing sets and an infusion pump. The nurse may also require other specialty equipment, such as vein finders and central line kits.

FIGURE 13.12 A typical IV start kit provides most of the equipment needed for peripheral IV insertion. The contents may vary according to manufacturer. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Needle Size and Cannula Type

Before starting an IV, it is important to consider what type of procedures and IV therapies the patient will need. Select an appropriately sized needle based on the clinical needs of the patient. Intravenous needles are sized by gauges, with smaller gauges indicating larger needles and larger gauges indicating smaller needles. Peripheral intravenous catheter (PIVC) range from 14 gauge to 24 gauge. Catheter sizes are color-coded to allow easy identification of size of the gauge by the cannula hub after vein access.

Typically, providers use 18-, 20-, or 22-gauge IV needles. However, 24-gauge needles are used most often for pediatric patients and older adults, and 16-gauge needles are most often used in adults undergoing surgery or receiving care in the intensive care unit. Larger gauges, such as 16- or 18-gauge needles, work best to give infusions rapidly. Smaller-gauge needles, such as 22-gauge needles, may be ideal if the patient is stable and will not need fluids at a fast rate or require IV therapies for very long. The gauge size is also dependent on the size and quality of the patient's vein. For example, a smaller needle may be required for small veins. If the patient already has an IV, the nurse must consider if the IV is appropriate for administering the ordered medications (i.e., is the IV gauge the right size for the infusion, does the IV site flush easily, are the medications compatible). Blood products, for example, are best infused through larger-gauge IVs but may be given through smaller-gauge catheters at a slower rate (INS, 2024).

Intravenous cannula types can differ by agency and manufacturer (Figure 13.13). A **shielded catheter** is an IV catheter with a retractable needle that has a short extension tubing added to the end of the cannula after insertion. Shielded catheters come in different variations: some include a port or a **three-way stopcock**, a small, plastic, Y-shaped valve with three regulating ports, while others have a blood control valve that prevents blood from flowing out of the cannula until it is attached to **extension tubing**, a length of tubing with a connector that can be added to

the primary IV tubing to extend the reach of the IV line. A winged **"butterfly" cannula** is a needle with flexible plastic wings on either side of the needle hub that serve to maneuver the needle during the venipuncture procedure. They are manufactured with a short tubing attached to the cannula. These cannulas may use a **combi stopper**, which is a closing cone with Luer lock–fitting stoppers designed to seal the access points on IV devices to maintain sterility and prevent contamination, or an **antimicrobial filter**, a port protector containing alcohol that disinfects and protects the IV access point, to seal the end of Luer-lock connections.

(a) **(b)**

FIGURE 13.13 Facilities may use different types of IV cannulas. A (a) Luer-lock system is the most commonly used, followed by a (b) direct access IV. (credit a: "Cannula A.jpg" by Wikimedia Commons, Public Domain; credit b: "Saline lock" by Glynda Rees Doyle and Jodie Anita McCutcheon/British Columbia Institute of Technology, CC BY 4.0)

Tubing Sets

When administering IV fluids and medications, it is also important to select the correct IV tubing set. Intravenous tubing sets may be categorized as primary or secondary sets (Figure 13.14). Blood tubing, a specialized type of primary set, is specifically designed for the safe and controlled administration of blood and blood products to patients. Blood tubing contains two spikes (one for the blood and one for the flush) and a filter to trap blood clots and debris and does not contain any access ports. Another specialized type of IV tubing is filtered tubing. Filtered tubing is designed to remove particulate matter, microorganisms, and other contaminants from IV fluids or medications before they reach the patient's bloodstream and are used when administered lipids, parenteral nutrition (PN), and some chemotherapy drugs. Selecting the correct IV tubing set is critical to ensure that fluids and medications infuse correctly.

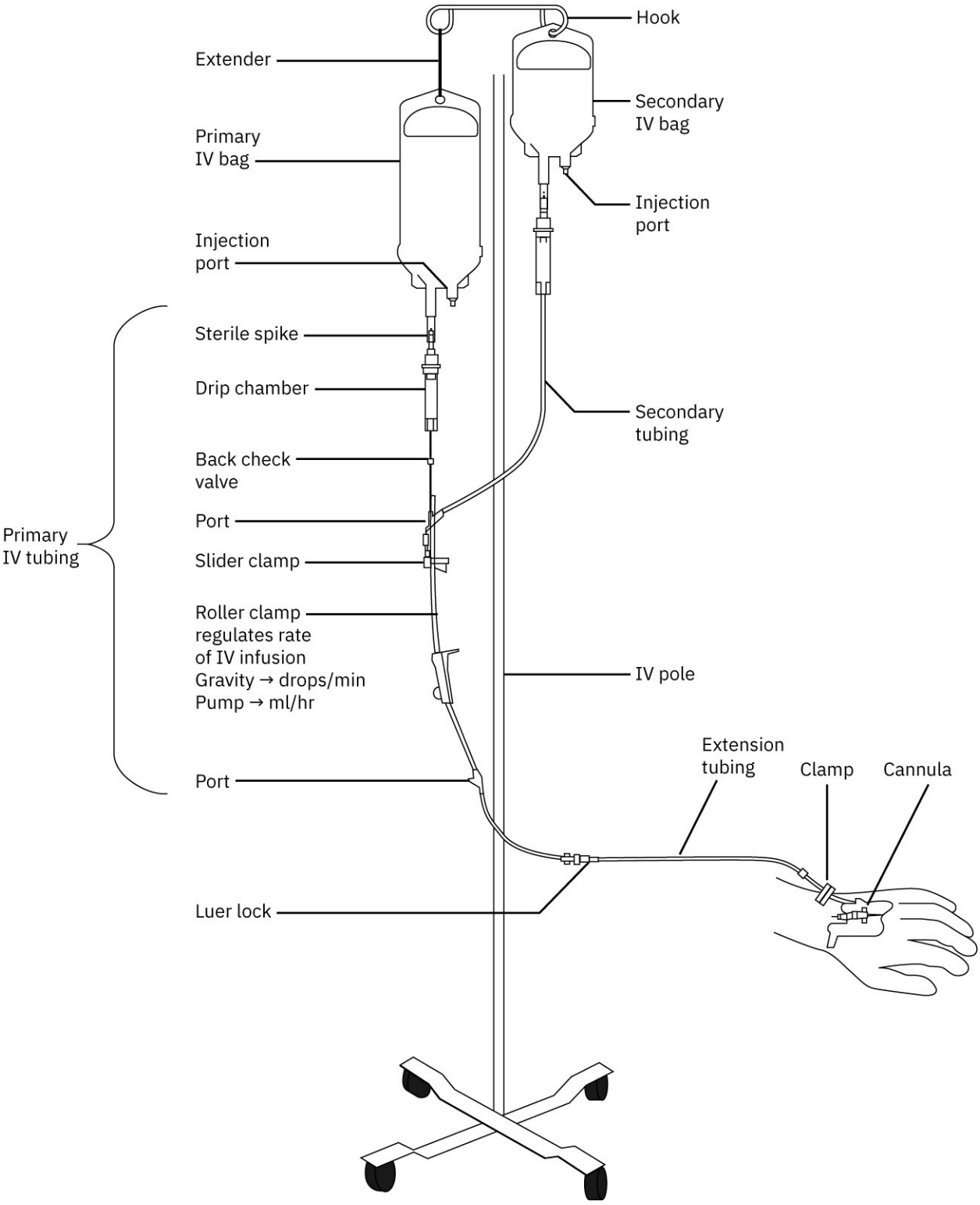


FIGURE 13.14 It is important that the nurse ensure proper setup of primary and secondary IV tubing before administering IV infusions. (credit: modification of "IV Primary and secondary tubing set up" by Glynda Rees Doyle and Jodie Anita McCutcheon/British Columbia Institute of Technology, CC BY 4.0)

Primary Sets

A primary set is used to infuse primary IV fluids, such as 0.9 percent normal saline, lactated Ringer solution, and D5W. Infuse primary fluids into the body on a continuous or intermittent basis, depending on the patient's condition and provider's orders. Primary IV tubing can be a macrodrip or microdrip solution set. A **macrodrip** infusion set delivers ten, fifteen, or twenty drops per milliliter, whereas a microdrip infusion set delivers sixty drops per milliliter.

The drop factor is located on the packaging of the IV tubing and is important to verify when calculating medication administration rates. Macrodrip sets are used for routine primary infusions for adults. Microdrip IV tubing is used in pediatric or neonatal care where small amounts of fluids are administered over a longer period of time. Packaging displays how much fluid it takes to prime the tubing if you are giving precise doses.

Primary sets comprise a sterile spike, drip chamber, backcheck valve, access ports, and a roller clamp. The sterile spike is used to spike the IV fluid bag. It must always remain sterile to prevent contamination. The drip chamber collects any air present in the line and calculates the rate of fluid administration. The drip chamber should always be one-quarter to one-half full of solution. The backcheck valve prevents fluids and medications from traveling into the primary IV bag. Access ports administer secondary and IV push medications. Primary tubing typically has two access ports, one just below the drip chamber and one closer to the patient. The roller clamp regulates the speed of the infusion or stops the infusion when running by gravity.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Initiating a Peripheral Venous Access Intravenous Infusion

See the competency checklist for Initiating a Peripheral Venous Access Intravenous Infusion. You can find the checklists on the Student resources tab of your book page on openstax.org.

Secondary Sets

A **secondary set** is used to intermittently infuse a secondary medication, such as an antibiotic. Secondary tubing is shorter than primary tubing, since it will be joined to the longer primary tubing at the Y-site, and is composed of a sterile spike, drip chamber, and roller clamp. Unlike primary tubing, secondary tubing does not have access ports. The secondary tubing is connected to the primary tubing via the access port closest to the drip chamber.

The secondary IV bag hangs above the height of the primary IV bag to allow gravity to infuse the secondary medication, followed by infusion of the primary fluids. The flow of fluids is determined by the height difference or pressure gradient between the IV bag and the patient's IV access point. When the secondary bag is higher than the primary bag, gravity exerts a stronger downward force on the fluid in the secondary bag, causing it to flow into the IV tubing and then into the patient's vein more rapidly. Conversely, the primary IV fluid bag is typically hung at a lower height relative to the secondary bag. This lower position results in a weaker gravitational force, slowing the flow rate of the primary IV fluid to allow for control over the order in which fluids or medications are infused into the patient's bloodstream.

To ensure that the patient receives the full dose of medication, "piggyback" the secondary fluids into the primary IV line. If the medication were to be hung as a primary line, some of the medication would remain in the IV tubing once the infusion was complete, and the patient would receive less than the prescribed dose. By "piggybacking" the secondary line into the primary line, the primary fluids can flush any remaining medication in the IV line into the patient.

Flushes

A **flush** is a prefilled syringe used to keep the IV line free of air, open, and unobstructed. Flushes typically come into play when the IV is not connected to continuous IV fluids. The IV site should be flushed before and after administering medications, after blood sampling, after each infusion, as well as every twelve hours when the IV is not in use. An IV site may be flushed with normal saline or heparin, depending on the type of IV and provider's orders (Figure 13.15). As such, you will hear IV sites not connected to running fluids referred to as "saline locked" or "heparin locked."

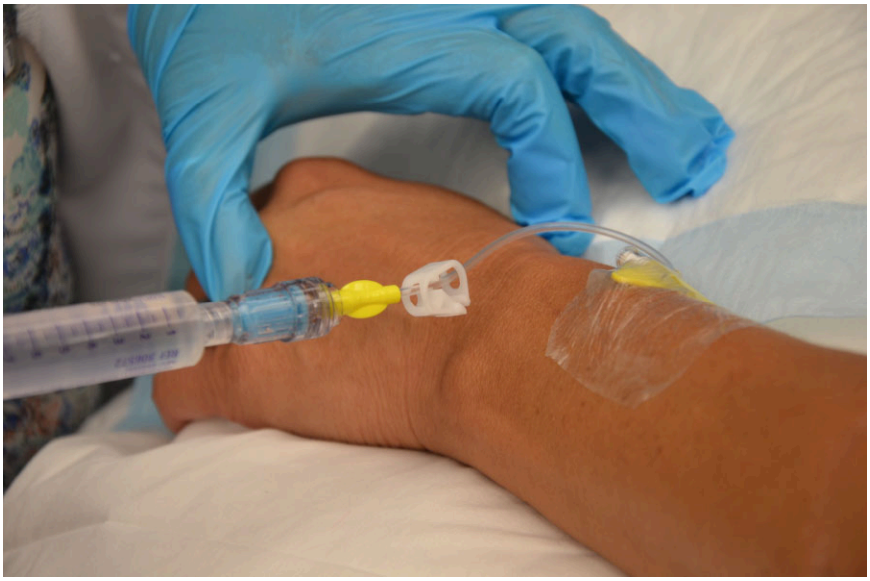


FIGURE 13.15 Part of a nurse's initial assessment includes flushing a saline lock IV with normal saline to ensure and maintain patency. (credit: "Flush the saline lock" by Glynda Rees Doyle and Jodie Anita McCutcheon/British Columbia Institute of Technology, CC BY 4.0)

Saline flushes contain a mixture of sodium chloride and water. Typically, use between 3 and 5 mL of normal saline to flush a peripheral IV site, depending on the agency's policy. When flushing the IV with saline, the patient may experience a salty taste in their mouth. If this occurs, you may explain to the patient that it is harmless and happens to many people. An open, correctly inserted IV should flush easily. If you feel resistance, do not force the flush, because the force may cause the vein to rupture or propel a potential blood clot into the bloodstream.

Heparin flushes contain varying strengths of the anticoagulant mixed with saline. Heparin is used to prevent clots from forming inside the IV catheter. When specifically prescribed by a healthcare provider, heparin flushes may be used on CVC or peripheral IV lines; however, careful monitoring is required due to the risk of adverse drug events related to the interference with the clotting process that results in a risk of bleeding (Institute for Healthcare Improvement, 2023). When flushing CVCs, always use a 10 mL syringe; smaller syringes may cause increased pressure in the catheter and subsequently cause the catheter to rupture.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Capping for Intermittent Use and Flushing a Peripheral Venous Access Device

See the competency checklist for Capping for Intermittent Use and Flushing a Peripheral Venous Access Device. You can find the checklists on the Student resources tab of your book page on openstax.org.

Infusion Pumps

An **infusion pump** is a medical device used to deliver IV fluids in controlled amounts (Figure 13.16). Using built-in software, the nurse can program the rate and duration of the IV fluid delivery. Infusion pumps offer significant advantages over administration of fluids by gravity, including the ability to deliver fluids in very small volumes and in precisely programmed rates and automated intervals.

FIGURE 13.16 Infusion pumps can have multiple channels to control primary fluids, intermittent infusions, and patient-controlled analgesia. (credit: "211221-F-DO876-004.JPG" by Airman Seth Haddix/U.S. Air Force, Public Domain)

Infusion pumps add safety measures when administering IV therapies. For instance, they are equipped with alarms to notify the nurse of problems, such as occluded tubing or air in the line, and the end of an infusion. Newer infusion pumps, known as smart pumps, may also alert the nurse of potential adverse drug interactions or when the pump is programmed outside of the established safety parameters. When it comes to administering critical fluids, such as high-risk medications and blood, agencies generally require infusion pumps to ensure that the patient receives the correct amount of fluid over the intended duration of time (INS, 2024; Institute for Safe Medication Practices, 2024).

Infusion pumps can be used for infusion of fluids and medications prepared in IV bags or syringes. Whereas IV bags are positioned on an IV pole above the pump with the IV tubing placed inside the pump, the syringe is placed in a syringe holder inside the infusion pump when using a syringe pump (Figure 13.17). The syringe pump controls the movement of the syringe plunger to deliver the medication or fluid at a precise rate. Syringe pumps are designed to minimize the risk of medication errors and ensure accurate and safe delivery of treatments due to their high level of precision and accuracy, ability to infuse low flow rates, and decreased risk of unintentional boluses (INS, 2024). Syringe pumps are particularly suitable for situations where precise control over the infusion rate is critical, such as in pediatric care, neonatal care, or when administering potent medications, such as chemotherapy or opioids (INS, 2024).

FIGURE 13.17 Syringe pumps are motorized devices that accurately control the movement of fluid from a syringe by mechanically engaging the plunger. Syringe pumps are the preferred choice for lower volume and low-flow-rate infusions. (credit: "Injectomat1.jpg" by Stefan Bellini/Wikimedia Commons, Public Domain)

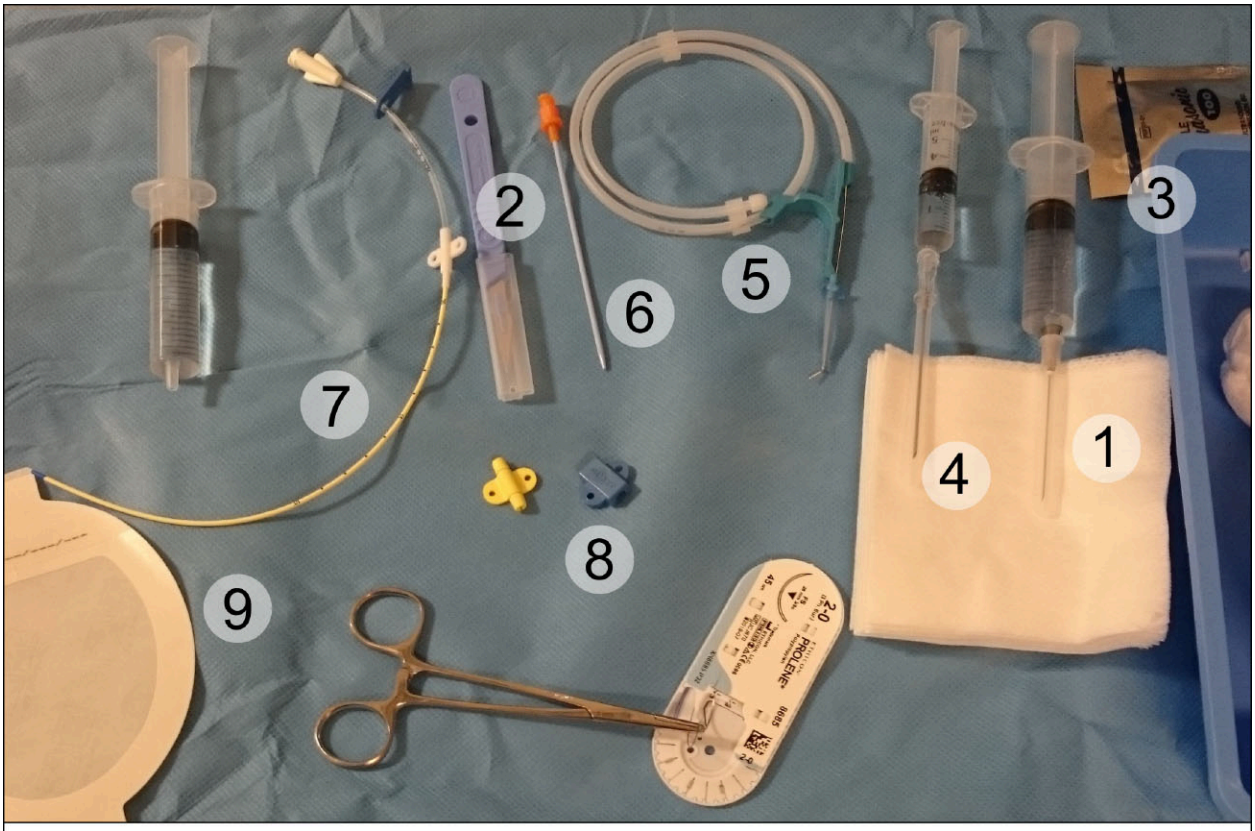
Specialty Equipment

You may need additional equipment in special circumstances. For example, a **vein finder** can help assist with peripheral IV insertion when it is difficult to visually locate the veins. Vein finders are devices that use infrared radiation reflection technology to create a map of veins. The vein map is projected onto the patient's skin, indicating to the nurse locations of the veins.

LINK TO LEARNING

Learn how to use a vein finder (https://openstax.org/r/77veinfind) in this video.

Only practitioners with advanced specialized training can insert CV access catheters. Special equipment needed includes a central line kit (Figure 13.18). Central line kits are sterile packages that include lidocaine, a syringe and needle to administer local anesthetic, syringe and introducer needle, scalpel, guidewire, tissue dilator, sterile dressing, suture and needle, and central line catheter. In addition, you will need a sterile gown, cap, gloves, sterile gauze, sterile saline, face mask, and chlorhexidine (or other antiseptic solution approved by the agency) when placing the central line. Nurses who are not certified to insert central lines can assist the practitioner by gathering the supplies needed to insert the line and assisting during the procedure. Ultrasound may be used to visualize the veins prior to beginning the procedure and to guide the central line placement. Once the central line is in place, a chest x-ray will verify correct placement of the central line prior to the line being used, if it was placed in the superior vena cava (Figure 13.19).



1. Syringe with local anesthetic
2. Scalpel in case venous cutdown is needed
3. Sterile gel for ultrasound guidance
4. Introducer needle (here 18 Ga) on syringe with saline to detect backflow of blood upon vein penetration
5. Guide wire
6. Tissue dilator
7. Indwelling catheter (here 16 Ga)
8. Additional fasteners, and corresponding surgical thread
9. Dressing

FIGURE 13.18 A sterile central line kit conveniently includes all the equipment needed to place central venous access in a patient. (credit: modification of "Central venous catheter set.jpg" by Mikael Häggström/Wikimedia Commons, Public Domain)

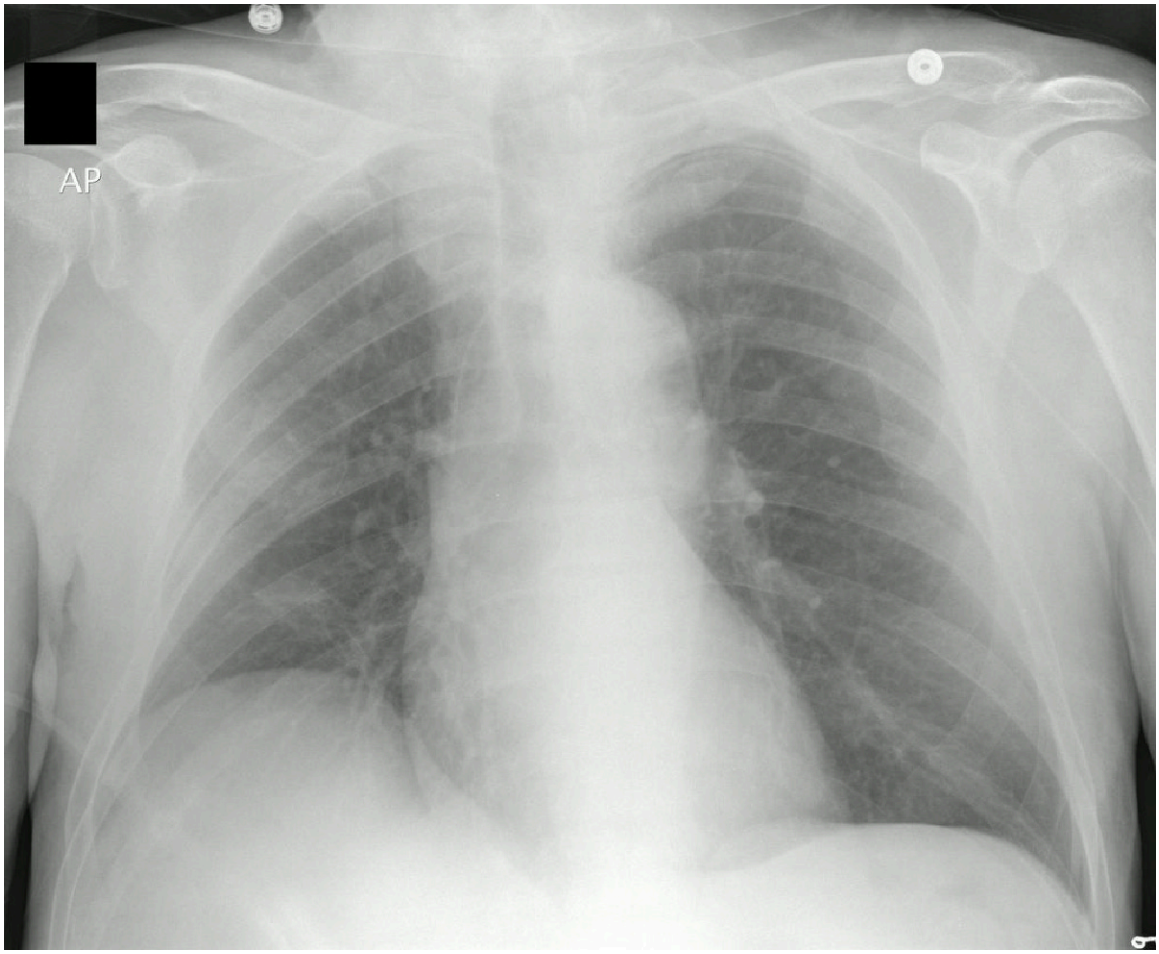


FIGURE 13.19 A chest x-ray confirms correct placement of the central line in the superior vena cava before use. (credit: “PICC line-correct position.jpg” by "Octavio L"/Wikimedia Commons, CC BY 2.5)

Peripheral Intravenous Catheter Site Selection

Nurses place PIVCs while at the patient’s bedside. Upper extremity veins commonly used for peripheral IV insertion include the dorsal venous network (back of the hand), median cubital (bend of the arm), accessory cephalic (upper forearm), and median antebrachial (inner forearm) (Figure 13.20).

In neonates or infants, you can also use the frontal, occipital, superficial temporal, or posterior auricular veins of the scalp. In some cases, the veins of the lower extremities may be used. Carefully select an insertion site that is according to agency policy and most appropriate for the patient.

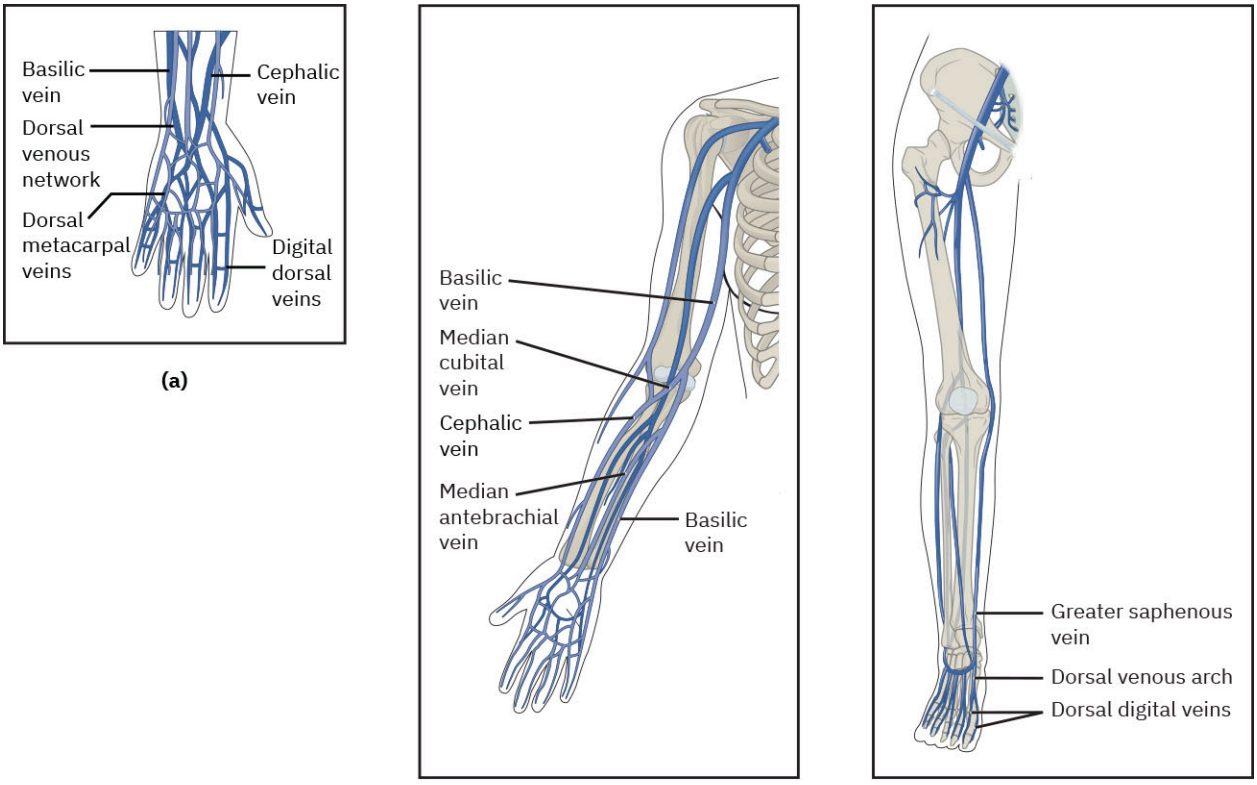


FIGURE 13.20 It is important to recall the anatomy of veins commonly used for peripheral IV placement, especially in the (a) hand and (b) arm. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

When selecting a peripheral IV site, it is important to start with the distal veins, such as the hands, before working your way up. This technique helps to preserve future access sites that may have to be placed more proximal than the vein selected. Placing subsequent IVs distal to the current IV site may cause IV fluids to leak into the intravascular space. The site of an IV insertion is like the site of a possible traffic jam. If you choose a site higher up on any limb, then if the vein infiltrates or has a traffic jam, all veins below it can no longer be used for IV insertion. Blood will still circulate to that area through smaller veins, but you cannot use those lower veins for an IV. The general rule is to try to choose a vein on the distal section of the limb first. Then if that vein infiltrates, go farther up the limb.

Veins should be large, smooth, and pliable. Avoid veins on the palmar side of the wrist due to potential nerve damage. Do not use the patient's dominant arm, if possible. Other factors that influence vein selection include the patient's general condition, type of solution to be administered, duration of the IV therapy, and availability and condition of the veins. Avoid veins that are in an upper extremity on the same side as a breast surgery with axillary node dissection or in an extremity with lymphedema or an arteriovenous fistula or graft. Veins should also be avoided on the side of a body that has had radiation therapy or in an extremity affected by a cerebrovascular accident.

Patient's General Condition

The patient's general condition may influence the choice of vein selection. For example, when the patient requires STAT IV therapy that needs to be initiated as quickly as possible, the nurse will likely select the largest vein that can be visually inspected or palpated, which is usually a median cubital vein within the antecubital region. While antecubital veins can typically be accessed rather easily, the IV will limit the patient's mobility of that arm, so you may opt to use the antecubital in the nondominant hand to ensure that the patient has full movement in their dominant arm. Avoid areas that are painful, open wounds, sites of infection, and areas of planned procedures.

Type of Solution to Be Administered

Another consideration for IV site placement is the type of solution to be administered. Vesicants, such as vancomycin, potassium chloride, dopamine, and phenytoin, require a larger vein, such as an antecubital vein. Rapid

infusions and blood products must be administered through a large-gauge IV. Most veins in the hands are too small to accommodate a large-gauge IV, so you will typically use a vein in the upper arm for these infusions. If the patient requires total parenteral nutrition (TPN) or medications that may cause skin damage if leaked into the peripheral tissue, such as chemotherapy, administer a central line.

Duration of the Intravenous Therapy

It is also important to consider the duration of the IV therapy. For example, if a patient requires continuous IV fluids for several days, avoid sites such as the antecubital, wrist, and hand. Due to the bend in the arm, antecubital veins will frequently occlude and are not conducive to long-term, continuous IV therapy. The wrist and hand are also not ideal sites for long-term IV therapy, because they also frequently bend and can be quite painful with movement. When a patient needs long-term IV therapy, as in weeks or months, consider placing a central line.

Availability and Condition of Veins

When selecting a vein, consider how straight the vein is. Straight veins are better than curvy veins to reduce the risk of the IV catheter infiltrating the subcutaneous tissue. The vein should feel spongy and nonpulsatile when palpated. Avoid veins that are branched, hard, curved, knobby, or pulsatile. Also steer away from veins that are compromised (bruised, infiltrated, sclerosed, engorged) or exhibit signs of phlebitis or other IV complications.

While there are several factors to consider when selecting an IV site, there are times in which the conditions of the veins are so poor that you must use whatever vein is available. For example, those with severe kidney or cardiac disease may not have great vein access. If veins are fragile, damaged, or difficult to locate, or one or both arms cannot be used for IVs, the provider may consider the patient to be a candidate for a central line.

13.3 Intravenous Infusion

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Examine various categories of IV fluids
- Recognize the different ways to regulate IV flow rates
- Recall the guidelines for catheter, solution, and tubing changes
- Identify expected versus unexpected findings with IV therapy

The use of IV therapy is common in the delivery of health care. Fluid replacement is one of the most common indications for requiring IV therapy. As the nurse, you will be responsible for initiating and maintaining IV infusions. This section prepares you to understand how IV fluid therapy works within the body; ways to regulate IV flow rates; and how to assess, maintain, and prevent complications related to IV therapy.

Categories of Intravenous Fluids

There are several different ways to characterize IV fluids. An IV fluid may be categorized as colloid and crystalloid, depending on the size of the molecules and whether the molecules are soluble or insoluble. An IV fluid may be further categorized by its tonicity as an isotonic, hypotonic, or hypertonic solution.

Colloids

A colloid contains large, insoluble molecules that are evenly dispersed throughout the solution. These molecules may be composed of proteins, complex polysaccharides, albumin, starches, and dextran. Because the insoluble molecules are large, they do not cross the capillary wall easily and remain in the vascular space longer than crystalloids. Therefore, you need less fluid volume when infusing colloids to achieve the same effect as crystalloids. Colloids are used to expand intravascular volume by drawing fluid from the extravascular space using high osmotic pressure. Indications for colloidal fluids include hypovolemic shock, burns, sepsis, trauma, and surgery. One disadvantage for the use of colloids is the cost.

Crystalloids

A crystalloid contains water-soluble electrolytes, such as sodium and chloride. Crystalloids lack the proteins and other insoluble molecules found in colloids. Because crystalloids contain water-soluble components, they cross the capillary wall easily and quickly. Therefore, you need more fluid volume when infusing crystalloids to achieve the same effect as colloids. Crystalloids increase fluid volume in the interstitial and intravascular spaces. Crystalloid fluids are the first choice for fluid resuscitation in the presence of hypovolemia, hemorrhage, sepsis, and

dehydration.

Tonicity

The ability of the solution to alter the volume of the cell by moving water in and out of the intracellular and intravascular spaces is referred to as tonicity. Solutions can be hypertonic, isotonic, or hypotonic (Figure 13.21).

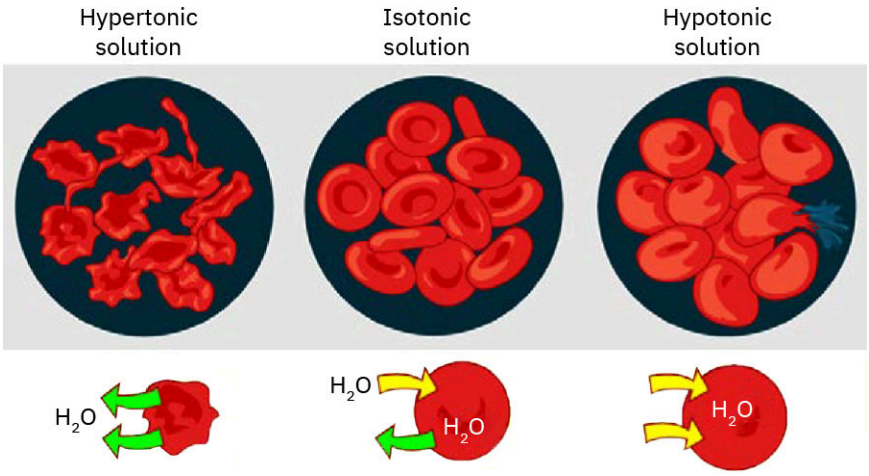


FIGURE 13.21 It is important to consider the osmotic effects of hypertonic, isotonic, and hypotonic IV fluids on red blood cells when monitoring the patient. (credit: modification of "Osmotic pressure on blood cells diagram.svg" by "LadyofHats"/Wikimedia Commons, Public Domain)

Hypertonic

A **hypertonic** solution contains a higher concentration of solutes than plasma and creates osmotic movement to pull the water from the cellular space into the intravascular space, causing the cell to shrink. Hypertonic solutions are also known as volume expanders because they increase extracellular volume (Vera, 2024). Examples of hypertonic solutions include 3 percent sodium chloride (3 percent NaCl), 5 percent sodium chloride (5 percent NaCl), 10 percent dextrose in water (D10W), dextrose 20 percent in water (D20W), dextrose 50 percent in water (D50W). It is important to monitor the patient for signs of hypervolemia and hyperglycemia. If the hypertonic solution contains saline, also monitor sodium levels closely. Due to the seriousness of the potential side effects, hypertonic solutions are typically administered in acute care settings because they require close monitoring of the patient's vital signs, electrolyte levels, and clinical status, as well as adjustments to the infusion rate as needed. Because hypertonic solutions are vesicants, they should be administered through a central line.

Isotonic

An **isotonic** solution contains a similar concentration of particles as plasma. Because there are equal concentrations in the intracellular and extracellular spaces once administered, osmotic movement does not occur, and the fluid stays within the intravascular space. Isotonic solutions increase extracellular fluid volume. They may be indicated when a patient requires fluid and electrolyte replacement, such as with blood loss, surgery, dehydration, and hypotension. Examples of isotonic solutions include 0.9 percent normal saline solution (0.9 percent NaCl), 5 percent dextrose in water (D5W), lactated Ringer solution in 5 percent dextrose (D5LR), and Ringer solution (Vera, 2024). When administering isotonic solutions, it is important to monitor the patient for fluid overload.

Hypotonic

A **hypotonic** solution contains a lower concentration of particles than plasma and creates osmotic movement that pulls the water from the intravascular space into the cellular space, causing the cell to swell. Hypotonic solutions are used to increase intracellular fluid volume. They may be indicated for patients experiencing diabetic ketoacidosis (DKA) or hyperosmolar hyperglycemia. Examples of hypotonic solutions include 0.45 percent sodium chloride (0.45 percent NaCl), 0.225 percent sodium chloride (0.255 percent NaCl), 0.33 percent sodium chloride (0.33 percent NaCl), and 2.5 percent dextrose in water (D2.5W). Too much hypotonic fluid can cause cerebral edema and can worsen hypovolemia and hypotension. Hypotonic solutions are contraindicated in patients at risk for increased cranial pressure or with extensive burns, liver failure, or trauma. Table 13.1 summarizes the characteristics of hypertonic, isotonic, and hypotonic IV solutions.

	Hypotonic	Isotonic	Hypertonic
Concentration of particles compared to plasma	Lower concentration of particles than plasma	Same concentration of particles as plasma	Higher concentration of particles than plasma
Used when	Less solutes in intravascular space than in intracellular space	Same solutes in intravascular and intracellular spaces	More solutes in intravascular space than in intracellular space
Examples	0.45 percent NaCl, 0.255 percent NaCl, 0.33 percent NaCl, and D2.5W	0.9 percent NaCl, D5W, D5LR, and Ringer solution	3 percent NaCl, 5 percent NaCl, D10W, D20W, and D50W
Osmosis	Shifts fluid *into* cells	No fluid shift	Shifts fluid *out* of cells
Indications	Cellular hydration, such as with diabetic ketoacidosis (DKA) or hyperosmolar hyperglycemia	Fluid and electrolyte replacement, such as with blood loss, surgery, dehydration, and hypotension	Hypovolemia, vascular expansion
Watch for	Cerebral edema, hypovolemia, and hypotension	Hypervolemia, edema, diluted laboratory values	Hypervolemia, difficulty breathing, elevated blood pressure, pulmonary edema, increased sodium, hyperglycemia, cellular dehydration, extravasations
Contraindications	Hypotension, increased intracranial pressure, extensive burns, stroke, liver failure, trauma	Volume overloaded patients	Cardiac and kidney failure (risk of pulmonary edema), dehydration

TABLE 13.1 Types of Intravenous Solutions

Ways of Regulating Intravenous Flow Rates

Intravenous fluid regulation refers to controlling the amount and rate of fluid received intravenously. Regulation ensures that you administer the correct amount at the correct rate. Failure to regulate IV flow rate appropriately can cause complications from receiving too much fluid too quickly or not enough fluid fast enough. There are several different ways of regulating IV flow rates, including gravity infusion, pump infusion, IV push, continuous single infusions, and continuous multiple infusions.

Gravity Infusion

When infusing IV fluids by gravity, the healthcare provider regulates the infusion rate by using a clamp on the IV tubing, which can either speed up or slow down the flow of IV fluids. An IV flow rate for gravity is calculated in drops per minute (gtt/min). To calculate the gtt/min, multiply the infusion rate (mL/hr) by the IV drop factor (gtt/min) found on the IV tubing, then divide by the infusion time in minutes. For example, a fluid that is to be infused at a rate of 75 mL/hr via 15 gtt tubing would infuse at a rate of 19 gtt/min [(75 × 15)/60 = 18.75 gtt/min]. Drops can only be administered whole, so round up if greater than 0.5, and round down if less than 0.5.

To ensure the correct rate, observe the drip chamber, and count the number of drips for one full minute.

Alternatively, divide the drops per minute by four to get the drops per fifteen seconds. For example, divide nineteen drops by four to determine that approximately five drops should fall every fifteen seconds. Assess the drops per minute regularly to make sure that the IV is infusing at the correct rate (e.g., check every one to two hours, if the patient accidentally bumps the IV tubing, or if a patient returns from another department).

Pump Infusion

With pump infusion, the infusion rate is regulated electronically, which delivers the fluids at the correct rate and volume. All IV pumps regulate the rate of fluids in milliliters per hour (mL/hr). Electronic pump infusion is recommended in all settings to reduce infusion-related medication errors (INS, 2024). Most IV pumps have embedded drug libraries in which the usual concentrations, rates, dosing, and dose limits are stored for each medication. The nurse carefully chooses the right medication, amount, and length of infusion required to ensure safe delivery of IV medications.

Intravenous Push

Medications via IV push are administered through the access port on the primary tubing that is closest to the patient. If the patient does not have continuous fluids running, flush the IV site before and after administering the IV push medication. Always follow the agency's policy, because some agencies require running fluids to be connected when administering IV push medications to prevent an accidental bolus of medication. The rate at which IV push medications are administered varies depending on the type of medication. A typical guideline is to administer 1 mL over one minute. Some drugs are administered more slowly, however, such as pushing 40 mg IV furosemide IV over two minutes to prevent hearing loss. Still other drugs should be administered more rapidly, such as pushing emergency medications as quickly as possible during a code. It is the nurse's responsibility to push the medication at the correct rate. If in doubt, you can find the IV push rate in medication guidebooks, in the electronic medication administration record (eMAR), or through the pharmacy.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering Medications by Intravenous Bolus or Push through an Intravenous Solution and Administering Medications by Intravenous Bolus or Push through a Medication or Drug-Infusion Lock

See the competency checklists for Administering Medications by Intravenous Bolus or Push through an Intravenous Solution and Administering Medications by Intravenous Bolus or Push through a Medication or Drug-Infusion Lock. You can find the checklists on the Student resources tab of your book page on openstax.org.

Continuous Single Infusions

Continuous single infusions are constant infusions of a parenteral drug over several hours or days. You will sometimes hear a continuous infusion referred to as a continuous drip. Examples of continuous infusions typically administered on medical units include heparin, insulin, and pantoprazole. Examples of continuous infusions typically administered in critical care settings (due to the need for close monitoring) include propofol, diltiazem, vasopressin, and nitroglycerin.

Monitor lab values closely when a patient is receiving medications via continuous infusion to ensure proper titration of the medication dose. Continuous infusions always include use of an IV pump to make sure the medication is being administered at the correct rate. Often, the patients will require IV fluids and medications in addition to the continuous infusion.

If the continuous medication and the primary IV fluids are compatible, you may be able to administer them through the same IV. To do so, connect each IV bag to separate primary tubing. Program each primary tubing set into the IV pump using a separate channel (Figure 13.22). Each channel will regulate the rate and duration of one medication being infused. The primary tubing of the IV fluids is then connected to the patient's IV site, and the tubing for the continuous infusion is connected to the access port located on the tubing of the IV fluids closest to the patient. If the medications and fluids are not compatible, the nurse may need to use more than one IV site simultaneously to infuse the medications.

FIGURE 13.22 Most electronic IV pumps have the ability to add channels for secondary or piggyback medications with a continuous single infusion. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering a Piggyback Intermittent Intravenous Infusion of Medication

See the competency checklist for Administering a Piggyback Intermittent Intravenous Infusion of Medication. You can find the checklists on the Student resources tab of your book page on openstax.org.

Continuous Multiple Infusions

Critically ill patients sometimes require coadministration of multiple continuous infusions. While the process is the same as continuous single infusions, administering multiple continuous infusions adds an extra layer of complexity during setup. The nurse must carefully consider compatibility of all medications running through the same tubing and IV site. Often, the situation will require additional IVs or a central line with multiple lumens.

To ensure patient safety, be certain to label all IV bags, tubing, and IV pump channels correctly, and make sure that they are connected to the intended IV tubing. The risk of error increases as you add more infusions into a patient's regimen. Not only should the nurse consider which medications can be administered through the same IV line, but

they should also confirm that the correct medication is running through the correct channel at the correct rate. Failure to do so could result in serious medication errors and patient harm.

Guidelines for Catheter, Solution, and Tubing Changes

To minimize the risk of infections, follow guidelines for catheter, solution, and tubing changes. According to the Centers for Disease Control and Prevention (CDC), peripheral IV catheters should be routinely changed no more frequently than seventy-two to ninety-six hours (Webster et al., 2019). Of course, the site may need to be changed more frequently if complications arise, such as infiltration or phlebitis. Some institutions, however, may opt to avoid routine IV catheter changes and change the IV catheter only when the site assessment looks abnormal with redness, swelling, or irritation.

Intravenous solutions are typically good for twenty-four hours after they are opened. If the solution has expired or been open for longer than twenty-four hours, dispose of the solution according to the agency's policy. If there is no date or time on the IV solution, assume the solution is expired and obtain a new bag of fluids. If the solution is still within date but appears cloudy or has precipitates, dispose of the fluids and obtain a new bag. Additionally, if the patient has an IV running but is prescribed a new IV mixture, the nurse must disconnect the old IV bag and administer the newly prescribed mixture. The old IV bag must be discarded according to facility guidelines.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Changing an IV Solution

See the competency checklist for Changing an IV Solution. You can find the checklists on the Student resources tab of your book page on openstax.org.

Primary IV tubing should be changed every seventy-two to ninety-six hours, depending on the agency's policy. If the tubing is secondary or intermittent fluids are administered, some agencies may require a tubing change every twenty-four hours due to the increased risk of contamination. Consider also the type of fluid being infused. For example, tubing used for total parenteral nutrition (TPN) must be changed every twenty-four hours, whereas tubing used for blood and blood products must be changed every four hours or four units, whichever comes first. Tubing for propofol must be changed every six to twelve hours, or when the vial is changed, to prevent bacterial growth. Intravenous tubing should also be changed if the IV tubing becomes disconnected or touches nonsterile surfaces.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Changing IV Tubing

See the competency checklist for Changing IV Tubing. You can find the checklists on the Student resources tab of your book page on openstax.org.

Central Venous Catheter Maintenance Bundles

A CVC requires special care. A CVC maintenance bundle may reduce the risk of CLABSIs. Typically, CVC maintenance bundles include proper hand hygiene, routine dressing changes, aseptic technique for accessing and changing tubing, standardized tubing changes, and daily review of catheter necessity. Perform proper hand hygiene prior to accessing the catheter, administering medication, changing the dressing, or palpating the catheter insertion site. Wear sterile gloves when changing the dressing. Cleanse the site with greater than 0.5 percent chlorhexidine solution for thirty seconds and allow it to dry completely before applying a sterile, transparent dressing or sterile gauze. Perform routine dressing changes at least every seven days or when the dressing gets wet or soiled (INS, 2024). Gauze dressings should be replaced every forty-eight hours (INS, 2024). Scrub catheter access ports and needleless connectors with chlorhexidine (or other approved antiseptic solution) prior to accessing the access port. Change needleless connectors no more frequently than every seventy-two hours, or according to the agency's policy. Change out IV tubing that is used continuously, including secondary sets, no more frequently than every ninety-six hours but at least every seven days. Exceptions to this replacement timeline include TPN, blood and blood products, chemotherapy, and propofol, which are changed more frequently according to the agency's policy.

The last portion of the bundle, assessing the need for the CVC, allows for daily review of the necessity of the catheter, so the catheter can be removed as soon as it is deemed medically safe to do so (INS, 2024).

Central Line–Associated Bloodstream Infection Guidelines

A **central line–associated bloodstream infection (CLABSI)** is a hospital-acquired infection caused by microorganisms being introduced into the bloodstream through the IV site, access ports, or contaminated IV tubing or IV solutions. CLABSIs are diagnosed by positive blood cultures and treated with antibiotics. As a result of bacteria entering the bloodstream, the patient may experience serious complications, such as bacteremia, bacteria in the blood, or sepsis, a dysregulated immune response to infection that triggers widespread inflammation throughout the body and potential organ failure. CLABSIs are adverse events that result in unnecessary healthcare costs and patient deaths each year.

It is important to note that CLABSIs are preventable. The number one way to prevent a CLABSI is to remove central lines as soon as is medically possible. If the patient does not have a central line, they cannot get a CLABSI. Another way to prevent the risk of infection is to adhere to all CVC maintenance bundles, including using strict aseptic technique for all line care and maintenance. Because CLABSIs are preventable, they are reported as an indicator of quality nursing care. The goal is to keep patients safe by having zero CLABSIs.

LINK TO LEARNING

The Joint Commission created a CLABSI Toolkit (https://openstax.org/r/77CLABSItool) that contains evidence-based strategies and techniques for preventing CLABSIs.

Expected versus Unexpected Findings with Intravenous Therapy

Patients receiving IV therapy are at risk for developing complications. Routine assessment is critical for preventing or reducing potential IV-related complications. Included in this assessment are inspection and ensuring IV patency, meaning that the IV line is open and unobstructed. To accurately assess the IV, the nurse must have a clear understanding of the expected versus unexpected findings with IV therapy. IVs should be assessed at the beginning of the shift, end of the shift, when the IV pump alarms, and upon administration of IV medications. Patient complaints of pain, tenderness, or discomfort at the site warrant additional assessments of the IV. Assessment of the IV includes assessing not only the IV site itself but also the tubing, rate, and solution.

LIFE-STAGE CONTEXT

Life Span Considerations when Assessing an IV

Children

Safety measures for a child with an IV infusion include assessing the IV site every hour for patency. Carefully assess and document frequently, per agency policy, infused volumes and signs of fluid overload. You can wrap the IV in gauze or use an arm board to deter the child from tampering with the IV site or tubing. Additionally, secure the tubing well and make sure that the dressing remains free from moisture, so the IV site is not compromised. Be aware that mobile children will require guidance to ensure that the tubing does not become obstructed if they sit or lie on it accidentally.

Older Adults

Frequently monitor older adults with an IV infusion for development of fluid volume overload. Signs of fluid volume overload include elevated blood pressure and respiratory rate, decreased oxygen saturation, peripheral edema, fine crackles in the posterior lower lobes of the lungs, or signs of worsening heart failure. Additionally, older adults have delicate venous walls that may not withstand rapid infusion rates. It is important to monitor the IV site patency carefully when infusing large amounts of fluids at faster rates, and appropriately modify the infusion rate.

Inspection

The nurses' inspection of the IV is as thorough as if they are about to start a new IV. Everything must be checked and double-checked. First, review the chart to determine the type of IV solution and rate of infusion ordered. Make sure that the correct solution is infusing and is not expired. Note the date and time of the bag currently being infused. If it has been twenty-four hours since initiation, most likely the bag must be changed. Check the label to see when the previous nurse started the infusion. If there is no label, then obtain a new bag. Generally, IV solutions are changed before they pass twenty-four hours. When in doubt or the label is unclear or absent, get a new bag and follow agency policy.

Inspect and make sure that the solution is infusing at the correct rate according to the medical administration record. If the IV solution is being infused via an IV pump, ensure that the rate is programmed correctly, the IV roller clamps are open, and the IV pump is plugged into the outlet. If a secondary infusion is running, be sure that the roller clamp is open and the secondary IV solution is hung above the level of the primary IV solution. If the IV solution is running by gravity, calculate and count the drip rate for one minute to verify that the medication is infusing at the correct rate.

Inspect the IV tubing to certify that there are no kinks or bends. Kinks or bends may prevent the flow of the infusion. Confirm that the tubing is neatly arranged and not tangled up in equipment or dislodged between the siderails on the bed. Assess the expiration date on the IV tubing. If the tubing is expired or not dated, discard the tubing, and obtain new tubing. Follow the tubing down to the IV site to make sure that the tubing is securely attached to the IV access port.

REAL RN STORIES

The Importance of Assessing Equipment before Use

Nurse: Kameka, RN
Clinical setting: Emergency department
Years in practice: 3
Facility location: Idaho

I was taking care of a patient who presented with high blood pressure. Another nurse on the unit started her IV while I went to prepare a dose of hydralazine. I went into the patient's room, found the access port on the IV line, and administered the prescribed dose of hydralazine. Upon reassessing the vital signs, the patient's blood pressure had not decreased. I followed the provider's orders and administered a second dose of hydralazine. Again, the blood pressure had not decreased when reassessed. While I was in the room, the patient asked for another gown, as she said her gown was wet. Come to find out, the IV tubing was not tightly screwed on the IV hub, and the IV fluids were leaking into the bed instead of going into the patient's vein. No wonder the blood pressure medication didn't work, it had leaked into her bed instead of going into her vein. I informed the patient what had happened, spiked a new bag of fluids with a new set of tubing, and informed the provider of the incident. The provider ordered another dose of hydralazine, and the patient's blood pressure subsided. Lesson learned, always check to make sure the tubing is secured to the IV site before administering medications.

Inspect the IV insertion site. The IV site should be free from pain, tenderness, redness, swelling, warmth, coolness, and leaking. If the site is painful, tender, red, swollen, warm, cool, or leaking, stop the infusion, remove the IV, document the assessment findings, and notify the provider. The transparent dressing should be clean, dry, intact, and secured to the skin. The IV site should be labeled with the date and time of the insertion, initials of the person who inserted the IV, the gauge of the IV, and the date the site is to be changed, according to the agency's policy.

Patency

Assess the **patency** of the IV to certify that the IV is open and the IV solution can freely flow into the patient's vein. If continuous fluids are running and the IV is not leaking or showing signs of phlebitis or swelling around the site, the IV is patent. If the IV fluid does not flow freely, the site is not patent, and the IV should be removed and restarted. Ensure that the dressing is properly protecting the site.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Changing a Peripheral Venous Access Site Dressing

See the competency checklist for Changing a Peripheral Venous Access Site Dressing. You can find the checklists on the Student resources tab of your book page on openstax.org.

If continuous fluids are not running, flush the IV every twelve hours to preserve patency and reduce the risk of thrombosis or occlusion of the line. Flush peripheral IVs with 3 to 5 mL of normal saline; flush central lines with 10 mL of normal saline or heparin, unless otherwise indicated by the provider's order or agency's policy. If the site does not flush, the site is not patent, and you should remove and restart the IV. Document patency and IV flushing as part of the routine IV assessment.

13.4 Blood Transfusions

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe steps for administering blood and blood products
- Understand procedures for initiation and transfusion of blood
- Recall different blood transfusion reactions

Blood transfusions are potentially life-saving procedures that replace deficits in blood volume or blood cells with blood donated by the patient (autologous donation) or another individual (Association for the Advancement of Blood and Biotherapies [AABB], 2018). A variety of clinical conditions may require administration of whole blood and blood products, individual components of blood, such as red blood cells, platelets, plasma, cryoprecipitated antihemophilic factor (cryo), white blood cells, and granulocytes. They may be needed to increase circulating blood volume after surgery, trauma, or hemorrhage. Other times, blood and blood products may be necessary to increase the number of red blood cells (RBCs) to maintain hemoglobin levels for those with severe anemia or to provide cellular replacement therapy. It is critical for the nurse to learn the proper method of administering blood transfusions and be able to identify potential adverse reactions.

Administering Blood and Blood Products

When administering blood and blood products, the nurse should always verify the provider's order, including the type of product, amount, date, time, rate, duration of infusion, and specific transfusion instructions, with another qualified provider (AABB, 2018; The Joint Commission, 2021). After verifying the order, the nurse should identify if the patient needs pre- or post-transfusion medications, assess related laboratory values, and understand why the transfusion is indicated for the patient.

The nurse may then explain the procedure to the patient and answer any questions they have. Ask the patient if they have ever received a blood transfusion in the past, and if so, how they tolerated the procedure and if they were premedicated prior to the procedure. Premedicating the patient prior to a blood transfusion may minimize the risk of allergic reactions to blood products. Indications for premedication may include patients with a history of an allergic reaction to blood transfusions, multiple transfusions, chronic illnesses, anxiety, febrile reactions, or autoimmune disorders.

Confirm blood type and crossmatch and await notification from the blood bank that the blood or blood products are ready to be administered. Just before obtaining the blood products, collect baseline vital signs, and notify the provider if temperature is greater than 100°F (37.8°C).

CULTURAL CONTEXT

Blood and Blood Products for Jehovah's Witnesses

Jehovah's Witnesses may refuse blood or blood product transfusions due to their religious beliefs. These individuals may refuse whole blood or primary blood components but may accept blood derivatives, such as albumin, clotting

factor, and immunoglobulins. It is important to assess patient religious beliefs that may interfere with treatment by blood transfusions, but never automatically assume they will refuse the treatment. Instead, educate the patient as to why the blood transfusion is needed, ask the patient about their individual preferences, and respect their wishes if they refuse the blood transfusion. If the patient does refuse the treatment, document the refusal, and notify the provider.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Preparing for a Blood or Blood Product Transfusion

See the competency checklist for Preparing for a Blood or Blood Product Transfusion. You can find the checklists on the Student resources tab of your book page on openstax.org.

Blood Typing and Crossmatching

Blood typing and crossmatching ensure compatibility of the donor's blood with the recipient's blood. The **blood typing** results identify the blood type and Rh factor. And **crossmatching** is used to check for harmful interactions between the donor's and recipient's blood. Blood typing and crossmatching are essential to caring for patient safety when a blood transfusion is required.

Blood Types

Blood type depends on the antigens found in the RBCs. There are four main types of blood: A, B, AB, and O. Type A blood contains type-A antigens. Type B blood contains type-B antigens. Type AB blood contains type-A and type-B antigens. Type O blood has no antigens, making it well suited for donation.

Rh Factor

Rh factor is determined by whether a certain protein, rhesus factor, is present on the RBCs. Blood may be classified as either Rh positive (+) or Rh negative (–). Rh+ blood contains the Rh protein on the RBCs, whereas Rh– blood lacks the Rh protein. Rh+ is the most common blood type, but Rh– blood does not indicate illness or affect one's health.

The Rh factor is one of the key factors that determine the compatibility of blood for transfusion. For a blood transfusion to be safe and successful, the recipient's Rh type must match the donor's Rh type. For example, a patient who is Rh-negative should receive blood from an Rh-negative donor to avoid potential transfusion reactions. Mismatched Rh factors during a blood transfusion can lead to adverse reactions, including hemolysis (destruction of RBCs), fever, jaundice, and more serious complications. Therefore, ensuring compatibility in terms of the Rh factor is crucial to prevent these reactions.

Blood Donors

When receiving a blood transfusion, it is important that the blood of the donor is compatible with the blood of the recipient. Antibodies may trigger immune reactions against blood that is incompatible. Persons with type A blood should only receive types A or O blood. Persons with type B blood should only receive types B or O blood. Persons with type AB blood are universal recipients and can receive types A, B, AB, or O blood. While persons with type O blood are universal donors and can give to anyone regardless of recipient's blood type, persons with type O blood may only receive type O blood. Type O blood is often used in emergent situations when blood typing cannot be performed.

In addition to the blood type, the Rh factor plays a critical role. Persons with Rh+ blood may receive both Rh+ and Rh– blood. Those with Rh– blood, however, can only receive Rh– blood. For the transfusion to be considered safe, both the blood type and Rh factor must be compatible (Table 13.2).

Blood Type	Can Donate To	Can Receive From
A+	A+, AB+	A+, A–, O+, O–
O+	O+, A+, B+, AB+	O+, O–

TABLE 13.2 Blood Compatibility by Type and Rh Factor

Blood Type	Can Donate To	Can Receive From
B+	B+, AB+	B+, B–, O+, O–
AB+	AB+	All types
A–	A+, A–, AB+, AB–	A–, O–
O–	All types	O–
B–	B+, B–, AB+, AB–	B–, O–
AB–	AB+, AB–	AB–, A–, B–, O–

TABLE 13.2 Blood Compatibility by Type and Rh Factor

Blood Components

Blood may be administered as whole blood or as individual blood components. Individual blood components can treat particular conditions and allow multiple people to benefit from one pint of whole blood. Blood components include RBCs, platelets, plasma, cryoprecipitated antihemophilic factor (cryo), white blood cells, and granulocytes. For example, a patient with low hemoglobin due to anemia can receive a red blood cell transfusion that contains just the RBCs. A cancer patient receiving chemotherapy can receive a platelet transfusion to correct a low platelet count. A person with clotting factor deficiencies can receive a transfusion of fresh frozen plasma to treat their specific clotting disorder.

A **red blood cell**, also known as an erythrocyte, is the most administered blood component. They carry oxygen from the lungs throughout the body and take carbon dioxide back to the lungs. As the name suggests, RBCs are red in color (Figure 13.23). Commonly referred to as **packed red blood cells**, they increase hemoglobin and iron levels and improve oxygen levels within the body. They are most frequently administered to patients experiencing anemia.

FIGURE 13.23 Packed red blood cells are labeled with unique numbers and packaged for transfusion. (credit: "160113-F-YM354-011" by Tech Sgt. James Hodman/U.S. Air Force, Public Domain)

A **platelet**, also known as a thrombocyte, is a small, colorless cell fragment that sticks to the lining of a blood vessel to stop bleeding. Platelets are often given to patients experiencing leukemia, blood disorders, or other types of cancer. Some patients with cancer require platelet transfusions as a side effect of chemotherapy, while other patients may have a type of cancer that itself stops the body from creating platelets.

The liquid portion of the blood that carries the red and white blood cells throughout the body is termed **plasma**. It helps to maintain blood pressure and volume, carries electrolytes to muscles, assists in maintaining pH balance, and supplies proteins for clotting and immunity. Plasma is yellow in color and must be kept frozen to preserve the clotting factor (Figure 13.24). Plasma transfusions are often required for those experiencing liver failure, severe infections, shock, bleeding disorders, or serious burns. During the COVID-19 pandemic, some patients with specific symptoms were treated with convalescent plasma therapy to possibly hasten their recovery.

FIGURE 13.24 Plasma is labeled and packaged for transfusion. (credit: "160113-F-YM354-006" by Tech. Sgt. James Hodgman/U.S. Air Force, Public Domain)

A portion of plasma that is rich in clotting factors is termed **cryoprecipitated antihemophilic factor** (cryo). It helps reduce blood loss by slowing or stopping bleeding. It is white in color and must be kept frozen to preserve the clotting factor. Cryo is used for clotting disorders, such as hemophilia and von Willebrand disease.

The **white blood cells**, also known as leukocytes, help the body fight against disease. They destroy bacteria and create antibodies against bacteria, viruses, and diseases. While your own white blood cells help you to remain healthy, foreign white blood cells may suppress the immune system or be toxic when transfused in other persons. Some patients have very few white blood cells because of severe illness. A transfusion of white blood cells would help their body fight infection, in the same way that more soldiers are brought in to fight a battle.

The **granulocytes** are a particular type of white blood cell that protect against infection by destroying invading bacteria and viruses. They may be administered to treat infections that are not responsive to antibiotics.

Starting a Blood Transfusion

Before a blood transfusion, there are a number of steps nurses must take. Nurses should ensure completion of blood type determination and crossmatch, obtain baseline vital signs, and collect necessary supplies at the bedside, such as blood tubing and normal saline. The nurse must also explain the procedure to the patient and inform the patient to immediately report symptoms of a possible blood transfusion reaction, such as sweating, chills, chest pain, shortness of breath, headache, back pain, nausea, vomiting, or itching. Then it is time to obtain blood from the blood bank. As a general rule, only retrieve one package of blood or blood products from the blood bank at a time. A transfusion must be started within thirty minutes and must be completed within four hours of obtaining the blood. At the blood bank and once on the unit, the nurse must verify the identity of the patient, transfusion order,

transfusion consent, blood type, and compatibility before beginning the transfusion.

REAL RN STORIES

Preparation Is Important before Administering Blood Products

Nurse: Jocelyn, RN
Clinical setting: Inpatient orthopedic unit
Years in practice: 13
Facility location: South Carolina

As a nurse for over thirteen years, I have administered blood on numerous occasions. Administering blood requires careful planning to ensure that the process goes smoothly. Over the years, I have learned that up-front preparation can save you a lot of time and effort in the end. For example, prior to obtaining the blood, always check to make sure that the patient's IV is properly working, that you have a vital sign machine in the patient's room, and that you have the necessary supplies, such as blood tubing and normal saline.

I encountered a situation in which the patient's IV was saline locked; I went to hang the blood and found the IV was occluded. After two attempts to restart the IV, the IV team had to be called to restart the IV. Realizing time was ticking, I had to return the blood to the blood bank until the IV could be restarted. Another time, I was attempting to find a vital sign machine, but they were all occupied by the nursing aides. After searching the unit for over ten minutes, I finally located a vital sign machine. Then I had to find another nurse to verify the blood, which took another five to ten minutes. That left a very short window of time for the blood products to be initiated within the given twenty- to thirty-minute window. Other times, I have had the blood in hand and the second nurse waiting for me in the room only to find the blood tubing bin empty in the supply room. Thankfully, I was able to go to another department and borrow blood tubing, but it would have been more efficient to have gathered the blood tubing prior to obtaining the blood. These lessons have taught me to always plan ahead when administering blood so that everything is in the patient's room and ready to go once the blood has been gathered from the blood bank.

Start the infusion slowly for the first fifteen minutes, rates determined per facility policy. Remain at the patient's bedside for the first fifteen minutes and monitor for adverse reactions (INS, 2024). After fifteen minutes, retake and document vital signs. If vital signs remain stable and the patient does not display symptoms of a reaction, increase the rate of the blood according to the agency's policy. Obtain and document vital signs every hour for the duration of the transfusion. Instruct the patient and family to report any unusual reactions immediately (AABB, 2018). Once the transfusion has ended, clamp the blood tubing above the filter, open the roller clamp for the normal saline, and flush the tubing until no visible blood remains in the IV tubing. Disconnect the blood tubing from the patient's IV and discard the tubing in an appropriate biohazard container. Obtain and document a final set of vital signs as well as the patient's post-transfusion status.

Verification Protocols

After retrieving the blood or blood products from the blood bank, two nurses must verify the provider's order and ensure that the blood product label matches the information found on the patient's blood bank bracelet (AABB, 2018). One nurse should read the information from one source while the other nurse confirms the same information on the other source. Both nurses should verify the serial number, blood component, blood type, Rh factor, and expiration date match. Confirm the identity of the patient as well, by looking at the blood product label and patient's identification bracelet, the patient's name, date of birth, and medical record number. Both nurses should document their verification according to the agency's policy (Figure 13.25). If any discrepancies are noted, do not start the transfusion, and immediately notify the blood bank.

TRANSFUSION RECORD

DATE _____

PATIENT NAME: (First) _____ (Last) _____

ADDRESS: _____

DOB: _____ AGE: _____ GENDER: _____

CONTACT NUMBER: _____

EMAIL ADDRESS: _____

Wt: _____ lb / _____ kg Provider _____ Blood type _____

Patient PCV/TP _____ Donor PCV/TP _____ Crossmatch YES/NO

Previous transfusion YES/NO Previous pregnancy YES/NO Vomiting Prior transfusion YES/NO

Diagnosis _____ Transfusion reason _____

Blood Product

(circle one)

Stored whole blood
Fresh frozen plasma
Frozen plasma
Packed RBC
Fresh whole blood

Blood donor _____
Unit number _____
Unit size _____
Type of filter used _____

Start time: _____ AM/PM T: _____ HR: _____ RR: _____ MM: _____ CRT: _____

	15 min	30 min	45 min	60 min	90 min	120 min	180 min	210 min	240 min
Time									
Rate									
Temp									
Pulse/HR									
RR/effort									
MM/CRT									
BP									
Hives									
Vomiting									
Swelling/itching									
Volume infused									

Administration rates: _____

Start at 1 mL/kg/hr for 15 minutes, then 5 mL/kg/hr for 15 minutes, then a rate to deliver transfusion within 4 hours

Treatment notes: _____

Medications Administered

Name and Strength	Dose	Route	Time/Tech initials

FIGURE 13.25 Documenting blood administration may vary between facilities but includes the product infused, volume infused, and any adverse reactions noted during the transfusion. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Blood Tubing

When administering blood and blood products, it is critical to use tubing that is specially marked as blood tubing (Figure 13.26). Blood tubing is a Y-tube with a special micromesh filter that prevents blood clots and particles from accidentally being administered to the patient. Make sure that all roller clamps (two above the filter and one below the filter) are closed prior to proceeding. Using one of the Y-connectors, spike a bag of normal saline, unclamp the roller clamp above the Y-site on the saline tubing, squeeze the filter chamber until the saline covers the filter and

fills one-third to one-half of the drip chamber. Open the roller clamp below the drip chamber to prime the saline tubing all the way to the distal end of the tubing, then clamp the roller clamp.

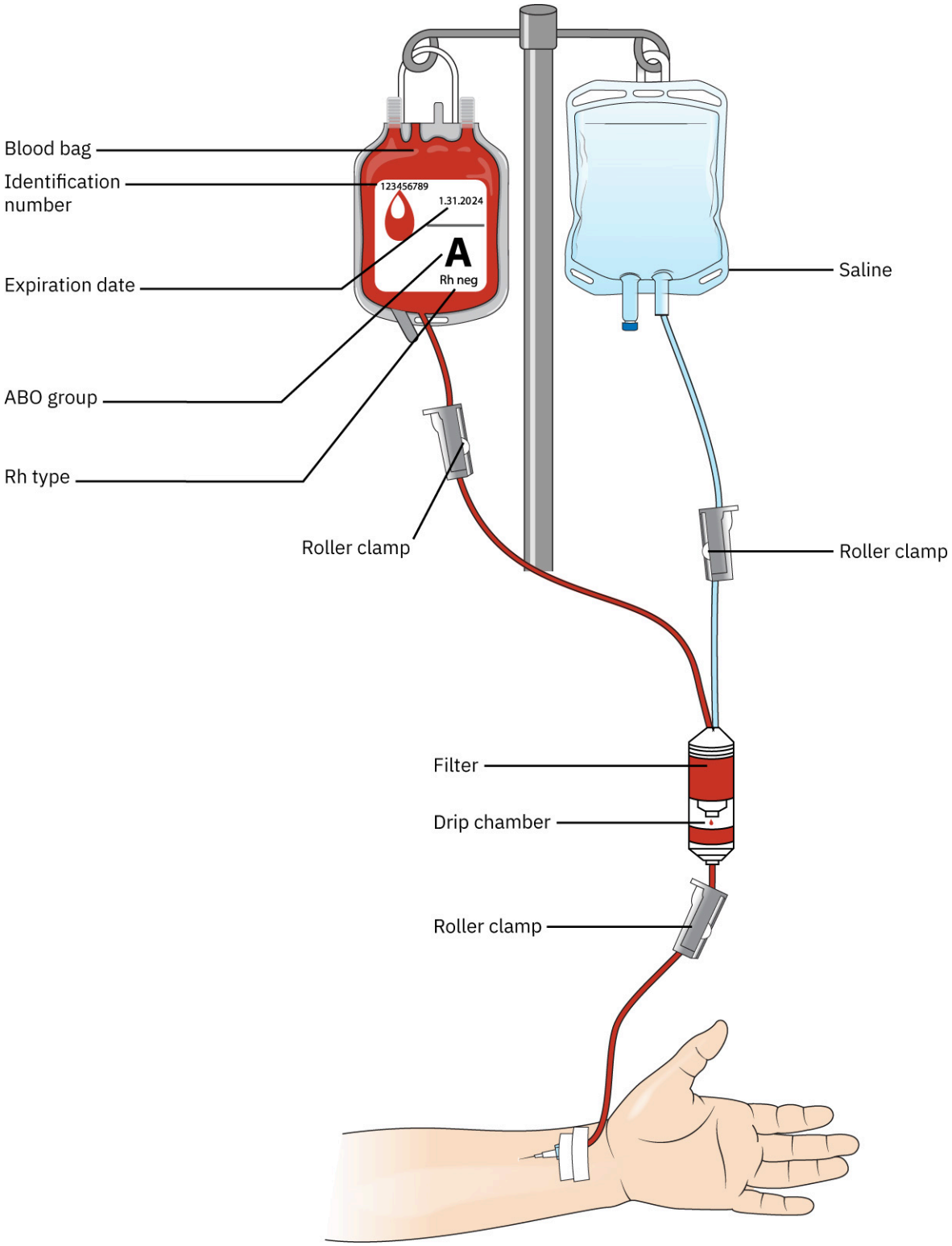


FIGURE 13.26 A Y-shaped tubing with filter is used when administering blood and blood products. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Spike the blood with the other Y-tubing by carefully inserting the IV tubing into the port, being careful not to puncture any portion of the blood bag except the port area. Ensure the spike is completely entered into the blood bag. Unclamp the roller clamp on the blood Y-tubing and squeeze the filter chamber until the blood covers the filter.

Write the date and time on the blood tubing because blood tubing should be changed at least every four hours to reduce the risk of bacterial growth.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering a Blood Transfusion

See the competency checklist for Administering a Blood Transfusion. You can find the checklists on the Student resources tab of your book page on openstax.org.

Transfusion Reactions

When administering blood and blood products, there is always a risk of a transfusion reaction. Reactions may be mild or severe and occur within twenty-four to forty-eight hours post-transfusion. Transfusion reactions are categorized as allergic, febrile, hemolytic transfusion, circulatory overload, or bacterial. While a reaction may occur at any point during the transfusion, most reactions typically occur within the first fifteen to twenty minutes after administration. As such, it is critical that the nurse remain with the patient for at least the first fifteen minutes of the transfusion (or longer if required by the agency's policy) and monitor vital signs. Monitor altered vital signs, such as increased temperature or respiratory rate, closely.

If you suspect a reaction, immediately stop the transfusion, and notify the provider. If the patient experiences an adverse reaction that may be uncomfortable but generally not life-threatening, considered a mild reaction, such as a fever, itching, rash, or mild discomfort at the infusion site, stop the transfusion and notify the provider. Many times, the provider will treat the symptoms (such as administering acetaminophen for a fever or diphenhydramine for itching) and continue the transfusion with close monitoring of the patient.

Moderate reactions are characterized by more pronounced symptoms that can cause discomfort and concern, such as moderate to severe shortness of breath, significant fever, and pronounced skin reactions. Moderate reactions can result from factors like transfusion-associated circulatory overload, more severe allergic responses, or worsening of mild reactions. In the event of moderate reactions, stop the transfusion, and notify the provider. Management of moderate reactions may involve slowing or stopping the transfusion as well as symptom treatment. Severe reactions are the most serious and life-threatening type of transfusion reaction. They can include severe respiratory distress, shock, renal failure, severe hemolysis (destruction of red blood cells), and cardiovascular collapse. Severe reactions are typically caused by major incompatibilities, such as ABO or Rh mismatches, transfusion of incompatible blood components, bacterial contamination, or acute hemolytic reactions. Severe reactions require immediate discontinuation of the transfusion, aggressive supportive care, and specific treatments tailored to the underlying cause. Management may include administering medications, providing oxygen, and ensuring hemodynamic stability.

In the event a transfusion reaction occurs and the blood is discontinued by the provider, disconnect the blood tubing and start normal saline with new IV tubing to keep the IV line open. If the patient is experiencing shortness of breath, sit the patient upright and start oxygen. Remain with the patient and monitor vital signs every fifteen minutes. Prepare to administer emergency medications, such as antihistamines, fluids, steroids, or vasopressors, depending on the provider's orders or standing protocols that may be in place. Collect blood and urine samples according to agency policy and provider orders. Check all blood bag labels, forms, orders, and the patient's identification band to determine whether a clerical discrepancy exists. Keep the blood container, tubing, and transfusion record and send to the blood bank for analysis. Document the symptoms, the time symptoms began, actions taken, as well as the patient's current condition. Complete an incident report according to the agency's policy.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Managing a Blood or Blood Product Transfusion Reaction

See the competency checklist for Managing a Blood or Blood Product Transfusion Reaction. You can find the checklists on the Student resources tab of your book page on openstax.org.

Allergic Reaction

An allergic reaction occurs when the immune system reacts to the donor's antibodies. Common symptoms of an allergic reaction include flushing, hives, rash, pruritus, difficulty breathing, laryngeal edema, wheezing, and possible anaphylaxis. Treatment for allergic reactions may include antihistamines, steroids, and epinephrine.

PATIENT CONVERSATIONS

What If Your Patient Experiences a Transfusion Reaction?

Scenario: Provider ordered two units packed red blood cells (PRBCs). The nurse initiated the first unit of PRBCs ten minutes ago.

Patient: Nurse, I don't feel so good.

Nurse: Mr. Jackson, can you tell me more about how you are feeling?

Patient: I'm itching all over, and I feel like my throat is tight.

Nurse: Mr. Jackson, I'm going to stop the blood transfusion for a moment until we know what is going on. I'm going to take a look at your arms, legs, and back and listen to your heart and lungs.

[Nurse assesses patient.]

Nurse: Mr. Jackson, I noticed you have a rash on your back and arms. I hear wheezing in your lungs, and your heart seems to be beating faster than usual. I think you are having an adverse reaction to the blood products. I'm going to leave the blood turned off and notify your provider.

Patient: Am I going to be okay?

Nurse: You are in good hands, Mr. Jackson. I am right here with you. Let's check your vital signs so we can monitor your condition. If you begin to feel any worse or feel that you can't breathe, please let me know.

Febrile Reaction

A **febrile reaction** occurs when there is hypersensitivity to the donor's white cells, platelets, or plasma proteins. Febrile reactions cause the body to build antibodies, so this is the most common reaction if the patient has received blood in the past. Common symptoms of a febrile reaction include sudden chills, fever, flushing, headache, and anxiety. Febrile reactions are treated with antipyretics, such as acetaminophen. Depending on the severity of the reaction, the provider may slow, stop, or continue the transfusion. If the transfusion is continued, carefully monitor the patient throughout the transfusion and promptly report any additional or worsening symptoms that may arise.

Hemolytic Transfusion Reaction

A **hemolytic transfusion reaction** is a severe and potentially life-threatening complication that occurs when a patient receives incompatible blood products. Common symptoms of a hemolytic transfusion reaction include low back pain (first sign), chills, feeling of fullness, tachycardia, flushing, tachypnea, hypotension, bleeding, vascular collapse, and acute renal failure. The patient may also experience a headache, nausea, and hemoglobinuria. Late symptoms may include fever and mild jaundice. Treatment for hemolytic transfusion reactions depends on the severity of the reaction and may include stopping the transfusion, frequently monitoring vital signs, administering IV fluids to maintain blood pressure, providing supplemental oxygen as needed, dialysis, management of bleeding, and supportive measures to manage the patient's symptoms.

CLINICAL JUDGMENT MEASUREMENT MODEL

Analyze Cues: Recognizing a Transfusion Reaction

The patient is receiving a unit of PRBCs. The nurse starts the transfusion at a slow rate and remains with the patient for the first fifteen minutes. Five minutes after starting the transfusion, the patient states, "Can I get another pillow to put behind my back? It is hurting a bit, and I can't seem to get comfortable." Back pain is a cue that requires a quick-acting response by the nurse; however, there is not enough information to analyze the

significance of the cue. The nurse may promptly ask the patient additional questions, such as, "Is your back pain new or was it bothering you earlier today?" "Can you point to where it is hurting?" The nurse may also perform a quick physical assessment to learn more about the cue. Upon assessment, the patient reports that the pain is a new pain occurring in the lower back. Using critical thinking, the nurse quickly considers factors that could potentially cause the symptoms, such as sitting for too long, sleeping on the back wrong, referred kidney pain, or a hemolytic transfusion reaction.

To narrow down a potential cause, the nurse may need to ask additional questions. The nurse asks the patient, "Do you feel any additional symptoms, such as chills, feeling of fullness, nausea, or headache?" The patient reports a slight headache coming on. The nurse obtains a set of vital signs and notes the patient is slightly tachycardic and that their blood pressure has slightly dropped from the baseline vital signs. Upon physical assessment, the patient is flushed and tachypneic. By recognizing and analyzing the quick onset of cues such as lower back pain, headache, tachycardia, blood pressure dropping, flushing, tachypnea, and recent initiation of a blood transfusion, the nurse forms a hypothesis that the patient may be experiencing a hemolytic transfusion reaction, stops the transfusion, and immediately notifies the provider.

Circulatory Overload

A **circulatory overload** occurs when the blood is administered at a rate faster than the circulatory system can accommodate. Common symptoms of circulatory overload include a rise in venous pressure, dyspnea, crackles or rales, jugular vein distension, cough, and elevated blood pressure. Treatment for circulatory overload includes positioning the patient upright, lowering the feet in a dependent position, diuretics, oxygen, and bronchodilators.

Bacterial Reaction

A **bacterial reaction** occurs when the blood or blood products are contaminated with bacteria. Common symptoms of a bacterial reaction include rapid onset of chills, vomiting, marked hypotension, and a high fever. Typically, blood cultures and other laboratory tests (complete blood count, coagulation studies, assessment of organ functioning) will be collected to diagnose or confirm this type of reaction. Treatment for bacterial reactions includes antibiotics, increased hydration, steroids, and vasopressors.

Summary

13.1 Principles of Intravenous Therapy

Intravenous therapy administers fluids, electrolytes, blood products, nutrition, and medications directly into the vein, thereby bypassing the gastrointestinal system. With 100 percent of the solution being administered into the vein, therapies infused via the IV route have a quick onset, and providers have better control over dosage. When using the IV route, the nurse must monitor the patient for potential complications such as infection, damage to the vein and surrounding tissue, air emboli, blood clots, and fluid overload. The IV route is an effective way to administer antibiotics, pain medications, emergency medications, chemotherapy, and immunoglobulins (IVIG).

13.2 Intravenous Device Insertion

For the safe and effective administration of IV medications, the nurse must choose the most appropriate IV access. There are three main categories of IVs: PIVCs, midline catheters, or CVCs. The PIVCs are the most common type of IV, and nurses routinely place them for short-term IV therapies. Midline catheters are longer than PIVCs and are used for patients with fragile veins or who require IV therapies for multiple days or weeks. The CVCs are primarily used for patients with critical illness, who require TPN or vesicant medications, or who need longer-term IV therapies.

When placing an IV, it is important to consider the type, rate, and duration of the IV therapy required. When starting peripheral IVs, the nurse must consider several factors in choosing a vein. These factors include the patient's general condition, type of solution to be administered, duration of the IV therapy, and availability and condition of the veins.

13.3 Intravenous Infusion

Intravenous fluids may be categorized by the size of the molecules, whether the molecules are soluble or insoluble, and by their tonicity (hypotonic, isotonic, and hypertonic). There are several different ways of regulating IV flow rates, including gravity infusion, pump infusion, IV push, continuous single infusions, and continuous multiple infusions. Infusion by gravity requires the nurse to calculate drops per minute (gtt/min) by multiplying the infusion rate (mL/hr) by the IV drop factor (gtt/min) found on the IV tubing, then dividing by the infusion time in minutes. Pump infusions are much simpler and more accurate, requiring the nurse to manually enter the infusion rate and volume amount in the IV pump. Other times, nurses administer IV push medications where the nurse must know how fast to push the medication.

To minimize the risk of infections, it is important to follow guidelines for catheter, solution, and tubing changes. Central venous catheter maintenance bundles may be implemented for patients with central lines to reduce the risk of CLABSIs. Routine assessment is critical for preventing or reducing potential IV-related complications. IVs should be assessed at the beginning of the shift, end of the shift, when the IV pump alarms, and when IV medications are administered. The IV should be patent, ensuring the IV line is open and the solution can freely flow into the patient's vein.

13.4 Blood Transfusions

Blood transfusions replace deficits in blood volume or blood cells with blood donated by another individual. Prior to administering blood and blood products, the nurse should always verify the provider's order and assess lab values to understand why the transfusion is indicated and to ensure the patient's blood has been typed and crossmatched. Blood typing and crossmatching are used to ensure blood compatibility of the donor and the recipient. The four blood types are A, B, AB, and O. In addition to the blood type, the Rh factor must also be considered.

In addition to whole blood, blood products may also be transfused. Blood products include RBCs, platelets, plasma, cryoprecipitated antihemophilic factor (cryo), white blood cells, and granulocytes. Prior to administering blood and blood products, it is important to ensure the patient has an appropriate IV site, the consent form is signed, and baseline vital signs have been taken. Ensure necessary supplies are at the bedside, including blood tubing and normal saline. The nurse remains at the bedside for the first fifteen minutes to carefully monitor the patient for a potential reaction.

If the vital signs significantly change and/or the patient has symptoms of a reaction at any point during the

transfusion, stop the blood, and notify the provider. Transfusion reactions may be categorized as an allergic reaction, febrile reaction, hemolytic transfusion reaction, circulatory overload, or bacterial reaction.

Key Terms

"butterfly" cannula needle with flexible plastic wings on either side of the needle hub that serve to maneuver the needle during the venipuncture procedure; are manufactured with a short tubing attached to the cannula
air embolus occurs when air or gas makes its way into the vascular system
antimicrobial filter port protectors containing alcohol that disinfect and protect the IV access point
bacterial reaction occurs when blood or blood products are contaminated with bacteria
blood typing identifies blood type and Rh factor
catheter a small hollow tube placed in the vein
catheter-associated thrombus an inflammatory response to an IV catheter that causes a blood clot to form and block one or more veins
central line–associated bloodstream infection (CLABSI) hospital-acquired infection caused by microorganisms being introduced into the bloodstream through a central line
central venous (CV) access also known as a central line, an IV inserted in or near a large vein that goes into the superior vena cava
central venous catheter (CVC) IV inserted in or near a large vein that goes into the superior vena cava
circulatory overload occurs when fluids are administered faster than the circulatory system can accommodate
combi stopper closing cone with Luer lock–fitting stoppers designed to seal the access points on IV devices to maintain sterility and prevent contamination
continuous infusion constant delivery of medication or IV fluid over an extended period of time, ranging from hours to days
crossmatching checks for harmful interactions between the donor's and recipient's blood
cryoprecipitated antihemophilic factor (cryo) portion of plasma that is rich in clotting factors
deep vein thrombosis (DVT) a blood clot that forms in a vein deep in the body
extension tubing a length of tubing with a connector that can be added to the primary IV tubing to extend the reach of the IV line
extravasation a condition that occurs when vesicant (an irritating solution or medication) is administered and inadvertently
febrile reaction occurs when there is a hypersensitivity to the donor's white cells, platelets, or plasma proteins
fluid overload occurs when there is increased fluid retained in the intravascular compartment
flush prefilled syringe that contains a small amount of normal saline or heparin used to keep IV site open and unobstructed
granulocyte type of white blood cell that protects against infection by destroying invading bacteria and viruses
hemolytic transfusion reaction occurs when incompatible blood products are administered
hypertonic contains a higher concentration of particles than plasma, so osmotic movement pulls the water from the cellular space into the intravascular space, causing the cell to shrink
hypotonic contains a lower concentration of particles than plasma, so osmotic movement pulls the water from the intravascular space into the cellular space, causing the cell to swell
implanted port central line that is surgically placed under the skin and accessed by needle when needed
infusion pump medical device used to deliver IV fluids in controlled amounts
intermittent infusion delivery of medication or fluid via an IV at a specific interval or scheduled time
isotonic contains a similar concentration of particles as plasma, so no osmotic movement occurs, and the fluid stays within the intravascular space
IV immunoglobulin (IVIG) human antibodies that are administered to help fight certain infections
IV push manually injecting medications into the IV line
lumen tube connected to the IV catheter and located out of the skin to administer medications
macrodrip ten, fifteen, or twenty drops per milliliter
midline catheter used for long-term IV therapy; catheter is longer than a PIVC but does not extend to the vena cava
necrosis tissue death
nontunneled percutaneous central venous catheter type of central line commonly used for emergent situations

packed red blood cells increase hemoglobin, iron, and oxygen levels within the body
parenteral nutrition (PN) nutrition delivered intravenously by a central line
patency open and unobstructed line
peripheral intravenous (PIV) line IV inserted into a peripheral vein, usually in the hand, arm, or forearm
peripheral intravenous catheter (PIVC) most common type of IV, placed in a peripheral vein
peripheral parenteral nutrition (PPN) diluted nutritional supplements that deliver nutrients and calories on a short-term basis
peripherally inserted central catheter (PICC) type of central line inserted peripherally
phlebitis inflammation of a vein
plasma the dominant component of blood that contains water, proteins, electrolytes, lipids, and glucose
platelet small, colorless cell fragment that sticks to the lining of a blood vessel to stop bleeding
red blood cell carries oxygen from the lungs throughout the body and takes carbon dioxide back to the lungs
Rh factor a certain protein, rhesus factor, present in some red blood cells
secondary set IV tubing used to intermittently infuse secondary medications
shielded catheter IV catheter with a retractable needle
short-term dosing a prescribed specific medication for a relatively brief duration
superficial vein thrombosis (SVT) a blood clot that involves superficial veins of the arms or legs
three-way stopcock small, plastic, Y-shaped valve with three regulating ports
total parenteral nutrition (TPN) total replacement of dietary needs over a long-term basis
tunneled central venous catheter central line that is tunneled under the skin and then brought out through a separate incision site
vascular access device thin, flexible catheter that provides access to blood vessels without the need for repeated needlesticks
vein finder device that uses infrared radiation reflection technology to create a map of the veins
vesicant drug that can cause blisters or tissue necrosis if leaked into the surrounding tissue
white blood cell helps the body to fight against disease

Assessments

Review Questions

1. The nurse enters the patient's room to address the IV pump that is alarming. The IV pump notifies the nurse that the infusion is occluded, and the IV fluids are not dripping to the drip chamber. The nurse notes the patient's IV site is cool, pale, and swollen. The nurse concludes the patient has experienced what complication of IV therapy?

a. infection
b. phlebitis
c. infiltration
d. thrombosis

2. The nurse is precepting a nursing student. What statement by the nursing student would warrant further education?

a. "Intravenous therapy is used to restore fluids and/or electrolyte balances more efficiently than the oral route."
b. "Peripheral parenteral nutrition is used for total replacement of dietary needs."
c. "Intravenous medications have a faster onset than oral medications since they are administered directly into the bloodstream."
d. "Intravenous infusions can help to eliminate fluctuations between peak and trough concentrations to maintain drugs with a narrow therapeutic window."

3. Upon assessing the patient's IV, the nurse notices the IV site is red, swollen, warm, and painful. What action should the nurse implement first?

a. stop the infusion
b. remove the IV

c. notify the provider
d. apply warm compress

4. Shortly after initiating an IV medication, the patient reports sudden shortness of breath and a feeling of impending doom. Blood pressure is 94/63, heart rate is 118, respirations are 24, temperature is 98.3°F (36.8°C), and oxygen saturations are 89 percent. The patient appears anxious and exhibits altered mental status. What is the priority nursing action?
a. Notify the provider immediately.
b. Place the patient in Trendelenburg position.
c. Apply oxygen.
d. Clamp the IV catheter.

5. The patient is scheduled to receive TPN. What type of vascular access and IV equipment should the nurse anticipate the patient needing?
a. peripheral IV catheter; flush
b. midline catheter; IV pump
c. PICCs; primary tubing
d. implanted port; secondary tubing

6. The nurse tells the nursing student to get a macrodrip infusion set. What would be considered a microdrip infusion set?
a. 10 gtt/mL
b. 15 gtt/mL
c. 20 gtt/mL
d. 60 gtt/mL

7. A new graduate nurse is flushing a saline locked IV with the preceptor. What actions by the new graduate nurse would warrant further education by the preceptor?
a. The nurse scrubs the access port with an alcohol swab for fifteen seconds and allows it to dry for thirty seconds before connecting the flush to the IV site.
b. The nurse pulls down on the plunger of the flush and gently expels the air from the syringe before connecting the flush to the IV site.
c. The nurse twists the flush onto the access port, opens the clamp on the tubing, and flushes the IV site.
d. The nurse clamps the tubing and then disconnects the flush from the IV site.

8. A new graduate nurse is reviewing types of access devices with the preceptor. What statement by the new graduate nurse demonstrates correct understanding of vascular access devices?
a. “A PICC line is not a good option if the patient requires long-term IV therapies because the patient cannot shower.”
b. “Tunneling the CVC increases the risk of infection.”
c. “Implanted ports can be left in place longer than any other type of central line.”
d. “Unlike other central lines, nontunneled percutaneous CVCs are not inserted into the superior vena cava.”

9. The nurse hears the provider state that a patient needs a hypotonic IV solution. What solution would the nurse expect to administer?
a. D51/2 NS
b. LR
c. D5W
d. 1/2 NS

10. The nursing student is reviewing IV fluid categories with the preceptor. What statement made by the student demonstrates a correct understanding of IV fluid categories?

a. "Hypertonic solutions are used to treat intracellular dehydration and hypernatremia."
b. "Crystalloids contain insoluble molecules that do not easily cross the capillary wall."
c. "Hypotonic fluids move water from the intracellular space into the intravascular space."
d. "Colloids are used to expand intravascular volume."

11. A patient is admitted to the hospital with dehydration and pneumonia. The patient is an IV drug user and is known to hate having IVs inserted. She now has an IV in the right arm. Upon conducting the shift assessment, the nurse notices the IV site is red, tender, and swollen. What action should the nurse take first?
a. Notify the provider.
b. Stop the infusion and remove the IV.
c. Remove the IV and apply a cool compress.
d. Apply a warm compress and elevate the extremity.

12. The provider places an order for IV D51/2NS at a rate of 75 mL/hr. The drop factor for the IV tubing is 20 gtt/mL. How many drops should fall into the drip chamber per minute?
a. sixteen
b. nineteen
c. twenty
d. twenty-five

13. The nurse is caring for a patient with a central line. What would demonstrate correct understanding of guidelines for caring for a central IV line?
a. Needleless connectors should be changed no more frequently than every seventy-two hours.
b. Transparent dressings should be changed every ninety-six hours or when wet or soiled.
c. Tubing used for secondary medications or intermittent fluids should be changed every twenty-four hours.
d. Gauze dressings should be changed at least every seven days or when wet or soiled.

14. What blood type is known as the "universal donor"?
a. type A
b. type B
c. type AB
d. type O

15. What blood type is known as the "universal recipient"?
a. type A
b. type B
c. type AB
d. type O

16. A patient started receiving their first unit of blood at 14:00. It is now 14:05, and the patient is reporting chills, headache, and anxiousness. Vital signs show the patient's temperature has increased from 98.4°F (36.9°C) to 99.7°F (37.6°C). What is the nurse's next action?
a. Calm the patient, and reassure them they will be okay.
b. Notify the provider.
c. Stop the transfusion.
d. Administer acetaminophen.

17. The nurse obtains a unit of blood from the blood bank. The unit of blood is started thirty minutes after receiving it from the blood bank. What is the maximum amount of time in which the blood must be transfused into the patient?
a. within one to four hours
b. within four hours

c. within 3.5 hours
d. within three hours

18. You are initiating a transfusion of PRBCs for a patient. You stay with the patient for the first fifteen minutes. What is your next action?
   a. Run the blood at a rate of 2 mL/min and then increase the rate after fifteen minutes, if tolerated by the patient.
   b. Run the blood at a rate of 120 mL/hr for the duration of the transfusion.
   c. Run the blood at a rate of 120 mL/min and then increase the rate after fifteen minutes, if tolerated by the patient.
   d. Run the blood at a rate of 2 mL/hr for the duration of the transfusion.

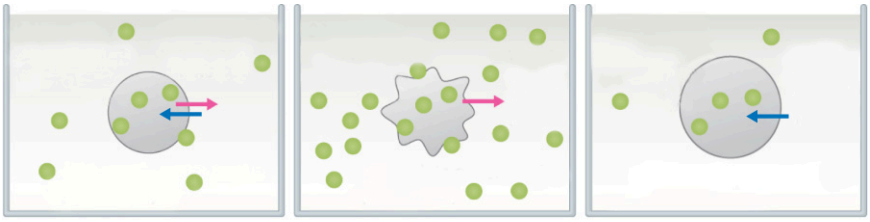
Check Your Understanding Questions

1. List five types of medications that may be administered via the IV route.

2. List three factors to consider when selecting a peripheral IV site.

3. The nurse is assessing the patient's peripheral IV to determine whether it is appropriate for administering an IV medication. How might the nurse determine the size of the IV gauge?

4. Label the diagram below with isotonic solution, hypotonic solution, and hypertonic solution.



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5. How often should peripheral IV sites be rotated? How long can an IV bag be used after opening? How often should the tubing be changed?

Reflection Questions

1. What are three indications for using the IV route for medication administration?

2. While IV therapies may be warranted for medications that require a quick onset, what are potential disadvantages associated with a rapid onset of IV medications?

3. What should the nurse do if the patient has continuous IV fluids running and an order for normal saline flushes every twelve hours?

4. Upon completing the shift assessment, the nurse assesses the patient's IV. The nurse notes the IV fluids and IV tubing are not dated. What should the nurse do?

5. The provider orders two units PRBCs for a patient experiencing anemia. Upon obtaining consent, the patient refuses the blood products. What are your next steps regarding alternatives to blood products?

6. The provider orders two units of PRBCs for a patient post hip replacement surgery. The first unit is started at 10:00. An IV antibiotic is scheduled for 12:00. What should the nurse do to ensure the patient receives the blood products and IV antibiotics?

What Should the Nurse Do?

The nurse is caring for a postoperative patient who just came out of recovery from having their appendix removed (appendectomy). The nurse works at a small, community hospital and is aware that an IV pump may or may not be

available, depending on how many IV pumps are in use each day. The provider orders 1,000 mL of normal saline over eight hours. The drop factor for the IV tubing is 15 gtt/mL.

1. Is normal saline categorized as an isotonic, hypotonic, or hypertonic solution?
2. If the fluid is infused by pump, what rate should be programmed into the pump?
3. If the fluid is infused by gravity, how many drops should fall into the drip chamber each minute?

Mr. Ramirez is a 72-year-old male admitted with serious burns obtained from a motor vehicle accident. Upon rounds, the provider orders plasma to be administered.

4. What must the nurse do to prepare for the plasma transfusion?
5. Mr. Ramirez asks, "What is plasma?" How should the nurse respond?
6. Upon picking the plasma up from the blood bank, the nurse notices it is yellow. What should the nurse do?

During the administration of the plasma, Mr. Ramirez begins coughing and appears to be having difficulty breathing. Vital signs are taken. Blood pressure is 150/93; heart rate is 104; temperature is 98.3°F (36.8°C); respirations are 26; and oxygen saturation is 93 percent. Baseline vital signs were blood pressure, 118/75; heart rate, 86; temperature, 98.2°F (36.8°C); respirations, 18; and oxygen saturation, 94 percent.

7. Which of the assessment findings are concerning?
8. What other assessments should the nurse perform?
9. What other symptoms is the nurse looking for in their assessments?
10. What is going on with Mr. Ramirez?
11. What actions should the nurse take?

Competency-Based Assessments

1. Demonstrate the appropriate procedure for changing IV tubing.
2. Demonstrate the appropriate technique for administering blood or blood products.
3. Role play what to do should the patient experience a blood or blood product transfusion reaction.

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CHAPTER 14

Miscellaneous Medication Administration

FIGURE 14.1 Eye drops are one of the alternative routes of medication administration. Other forms include ear, nasal, inhaled, vaginal, and rectal application routes. (credit: "Instilling Eye Medication" by British Columbia Institute of Technology, CC BY 4.0)

CHAPTER OUTLINE

14.1 Administering Eye Medications
14.2 Administering Ear Medications
14.3 Administering Nasal Medications
14.4 Administering Inhaled Medications
14.5 Administering Other Medications

INTRODUCTION Alternative methods of medication administration may be warranted when oral or parenteral routes are unavailable, when medications are poorly absorbed via the oral or parenteral routes, or when local effects are required. Other routes of medication administration may include the eyes, ears, nose, lungs, vagina, or rectum. As a nurse, you must be able to safely administer medications via any route ordered. This chapter will provide you with the necessary knowledge to demonstrate competence in administering medications via these identified routes.

14.1 Administering Eye Medications

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify different forms of eye medications
- Recognize the purpose of performing eye irrigation
- Describe procedural steps for eye medication administration

Eye (**ophthalmic**) medications are used to treat a variety of common conditions, such as allergies, dry eyes, viral or bacterial infections, and glaucoma. It is important for the nurse to be aware of the various types of eye instillation

medications, understand how to perform eye irrigation, and demonstrate appropriate administration of eye medications. Following proper procedures will ensure patients receive the maximum effect of the eye medication, reduce waste, and ensure safe administration of the medication.

Forms of Eye Instillations

Medications administered via the eye come prepared in a variety of forms, including drops, ointments, and medication disks. Generally, eye instillations should be used within thirty days of opening, unless otherwise indicated by the manufacturer. Expired eye instillations should never be used because they can become less effective or contaminated over time.

Eye Drops

Liquid solutions commonly used to treat conditions such as dry eyes, conjunctivitis (pink eye), glaucoma, red eyes, or itchiness are known as **eye drops** (Figure 14.2). They may be ordered as a prescription or found over the counter, depending on the symptoms and complexity of the condition. Examples of prescription eye drops include neomycin, bimatoprost, cyclosporine, and xalatan. Examples of over-the-counter eye drops include Refresh, Systane, Clear Eyes, and Visine. The medication bottle should always be assessed before use to ensure the medication is indicated for ophthalmic use.

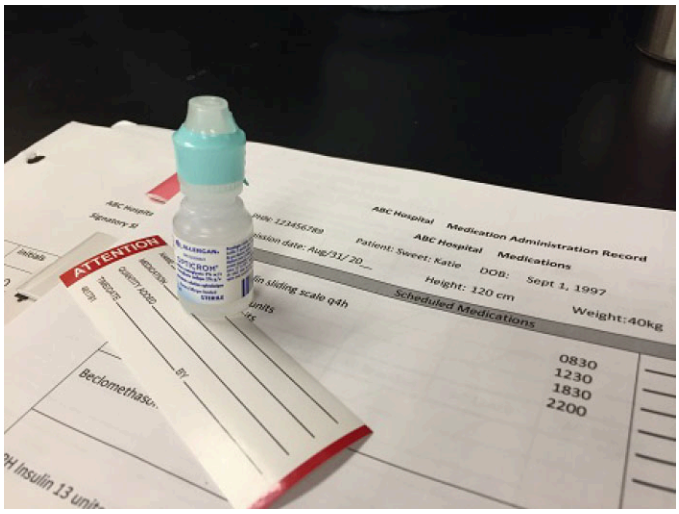

FIGURE 14.2 Eye drop packaging must be carefully observed because it is similar in appearance to ear drop and super glue packaging. (credit: "Drops with MAR" by Thompson Rivers University, CC BY 4.0)

Eye Ointments

Greasy, semisolids that use body warmth to melt into tiny drops that rest between the eyeball and eyelid (Figure 14.3) are known as **eye ointments**. Typically, eye ointments are thicker than eye drops and will stay in the eye longer. Examples of eye ointments include bacitracin ophthalmic ointment (Ocu-Tracin), erythromycin ophthalmic ointment (Eyemycin), and over-the-counter lubricant eye ointments.

FIGURE 14.3 Eye ointment is typically packaged in flexible plastic or metal tubes. (credit: Stefani Resseguie)

Eye ointments are known to cause blurred vision. It is important to instruct the patient that blurred vision may occur and will go away within a few minutes. Patients should be educated that they might be unable to drive, operate machinery, or engage in tasks that require the use of their vision until the medication dissipates. Some providers may order eye ointments to be administered at bedtime because of the blurred vision. Eyelashes and eyelids may be sticky after ointments are applied because of the thickness of the ointment. A warm, wet compress or washcloth may be applied to the eye after administration to remove any excess ointment that is excreted from the eye.

Eye Medication Disks

Small, flexible disks that can release medication in the eye for up to one week are known as **eye medication disks** (Figure 14.4). The disk is placed in the conjunctival sac horizontally and will naturally adhere to the eye. Instruct the patient to blink several times after placing the disk in the conjunctival sac. If the disk is still visible after blinking, pull the lower eye lid out and over the disk again until it remains below the eye lid when blinking.

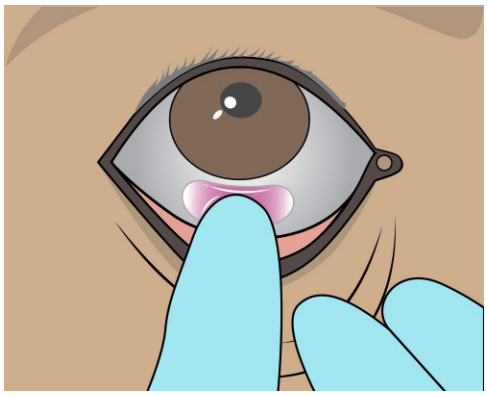

FIGURE 14.4 After performing hand hygiene and donning gloves, the provider inserts an eye medication disk in the conjunctival sac. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Medication disks should float between the eyelid and sclera. They may be repositioned by pressing a finger against a closed eye lid; however, the patient should be instructed not to rub the eye, which may cause the disk to move across the cornea. Medication disks can be used regardless of contact lenses, sleeping, or physical activities. To remove the disk, turn the lower eye lid outward and use your forefinger to slide the disk into the lid and out of the

eye. Patients receiving medication via an eye medication disk may complain of feeling like there is something in their eye, mild tearing, redness, increased discharge, and itchiness. Typically, these symptoms resolve within the first several weeks of usage; however, patients should be instructed to report persistent or severe symptoms.

Purpose of Performing Eye Irrigation

Washing out the eye with a continuous flow of liquid or medication, known as **eye irrigation**, may be warranted to flush secretions, chemicals, and foreign bodies from the eye. It may also be used to administer medications to treat certain disorders affecting the cornea or conjunctiva. Chemical injuries to the eye are considered an emergency and must be treated by irrigation immediately to prevent long-term vision loss. The amount of solution and duration of the irrigation depends on the contaminant.

Eye Irrigation Solutions and Procedure

Typically, normal saline is used to perform eye irrigation; however, water may be used in emergent situations, according to agency policy. The provider will order local anesthetic eye drops to be placed in the affected eye(s) before instilling the irrigation. The patient should be instructed to keep their eyes closed until the irrigation begins to retain the anesthetic in the eye. Assist the patient to lie down and place a towel over their neck and shoulders. Place a bowl or kidney dish against the patient's cheek, on the affected side, with the head tilted sideways toward it. After performing hand hygiene and donning gloves, fill the syringe with the irrigant and test the temperature on your hand. To prevent discomfort for the patient, the irrigant should be room temperature. Open the eyelid and ask the patient to fix their gaze ahead. Inject the irrigant slowly and steadily, from no more than 2 in (5 cm) away, onto the front surface of the eye, inside the lower eyelid, and under the upper eyelid (Figure 14.5). Ask the patient to move their eye in all directions while the irrigation is being performed. The provider should ensure the syringe remains sterile at all times and does not touch the surface of the eye or eyelid or any other object. A minute or two of irrigation should be sufficient for foreign body removal, whereas at least fifteen to thirty minutes may be required for chemical burns. Assess and document the patient's visual acuity and tolerance of the procedure when the procedure is complete.

FIGURE 14.5 After performing hand hygiene and donning gloves, the provider performs eye irrigation using aseptic technique. (credit: Heiko Philippin, Public Domain)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Irrigating a Patient's Eye

See the competency checklist for Irrigating a Patient's Eye. You can find the checklists on the Student resources tab of your book page on openstax.org.

Eye Medication Administration

When administering eye medications, it is important to confirm the rights of medication administration, including the number of drops to be administered (right dose) and the eye in which the drops should be placed (right route). Abbreviations used for eye instillations include right eye (OD), left eye (OS), and both eyes (OU). Ensure the medication is labeled for ophthalmic use and check the expiration date.

REAL RN STORIES

The Importance of Medication Route Verification

Nurse: John, RN
Clinical setting: Local hospital
Years in practice: Less than one year
Facility location: Orlando, Florida

I was a new graduate nurse and had been working at a local hospital for two to three months. I was caring for a 78-year-old female who was prescribed latanoprost (Xalatan) OD. I couldn't remember what the "D" was an abbreviation for, so I ended up asking another nurse on the unit for assistance. The nurse told me the "D" meant to administer the medication on the right side only. I collected the medication bottle and went into the patient's room to administer the drop. After entering the room I told the patient I was going to administer an ear drop. The patient was quite puzzled and asked to see the medication bottle. The patient recognized the name of the medication and informed me it was the eye drop she took for glaucoma. I quickly realized my mistake in thinking the "O" meant otic instead of *ophthalmic*. I still share this story today to reiterate the importance of knowing what medication is being given, how it should be given, and why it is being given before entering the patient's room.

Before administering eye medications, wash your hands and don gloves to prevent contamination. Assess the patient's eyes, noting any new or unusual redness or drainage. If discharge, dirt, or debris is present, gently cleanse the eyelid by dampening a gauze or washcloth with warm water or normal saline. Wipe the eye from the **inner canthus** (corner of the eye nearest the nose where the upper and lower eyelids meet) of the eye to the **outer canthus** (corner of the eye nearest the ear where the upper and lower eyelids meet) to avoid introducing dirt and debris into the lacrimal ducts, which could cause infection. Use a new gauze or corner of the washcloth with each stroke. Remove dirty gloves, wash hands, and don new gloves before administering the eye medication.

Shake the bottle, if indicated on the medication label. If the medication has been refrigerated, warm the bottle between your hands until it comes to room temperature. Instruct the patient to tilt their head back, or lie down, and look upward. Remove the medication cap and place it on a clean surface, without contaminating the inside of the cap or the dropper tip. Using the thumb and/or index finger, gently pinch the eyelid and pull downward to form a pocket. Turn the medication container upside down and gently squeeze the eye medication into the pouch formed in the lower lid (i.e., conjunctival sac), not directly into the eye (Figure 14.6). If another drop of eye medication is needed in the same eye, wait at least five to ten minutes before administering the second drop so the first drop will not be washed out of the eye.

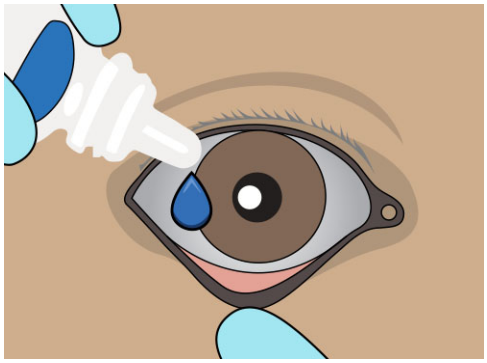

FIGURE 14.6 The provider gently pinches the patient's eyelid and pulls downward to form a pocket in the lower lid (i.e., conjunctival sac) where the eye drop is placed. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LINK TO LEARNING

Watch this demonstrational video about eye medications (https://openstax.org/r/77eyemeds) to learn how to administer them.

If an eye ointment is used, place a ¼ to ½ in (0.5 to 1 cm) line of ointment into the lower lid pouch, starting at the inner canthus and moving outward (Figure 14.7). Press one finger against the inner canthus of the eye for a few seconds, when appropriate, to keep the medication from going into the tear duct. A systemic reaction to the medication may result if the medication enters the tear duct. Instruct the patient to keep their eye closed for one minute, or as instructed by the provider, to allow the medication to be absorbed. If an eye drop and eye ointment are ordered for the same eye at the same time, administer the eye drop first, followed by the ointment. Perform hand hygiene and document administration of the medication as well as the patient's tolerance of the medication and procedure.

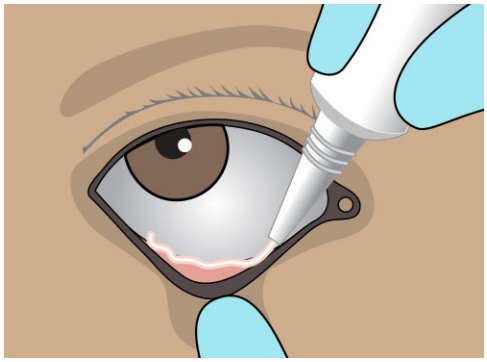

FIGURE 14.7 Place a ¼ to ½ in (0.5 to 1 cm) line of ointment into the lower lid pouch (i.e., conjunctival sac), starting at the inner canthus and moving outward. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Incorrect use of eye drops is a common problem. When eye drops are not administered properly, the full benefit of the medication may not occur. For example, if the drop does not enter the eye, the medication will spill down the cheek and the medication will be wasted. If the patient wears contact lenses, the contacts should be removed before administering eye instillations, unless otherwise indicated by the provider. It is also important to ensure that the dropper or ointment tube does not touch the eye or your fingers, which may contaminate the medication. Always recap the medication container immediately after use. Do not wipe or rinse the tip of the container. Eye medications are for single-patient use only and should never be shared with other patients because of the risk of contamination.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Instilling Eye Medication

See the competency checklist for Instilling Eye Medication. You can find the checklists on the Student resources tab of your book page on openstax.org.

14.2 Administering Ear Medications

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify different forms of ear medications
- Recognize the purpose of performing ear irrigation
- Describe procedural steps for ear medication administration

Ear (i.e., **otic**, **auricle**) medications are used for a variety of ear conditions (e.g., treating infections or inflammation, administering local anesthesia, softening **cerumen** (earwax) for removal, and facilitating removal of objects from the ear canal). The internal ear is sensitive to extreme temperatures; therefore, ear medications should always be administered at room temperature to reduce the risk of vertigo and cold sensitivity in the ear. The nurse must demonstrate competence in administering ear medications to ensure safe patient care.

Forms of Ear Instillations

Sterile technique should always be used for instilling medications in the ear. Sterile technique reduces the risk of infection if the eardrum is ruptured. In cases where a surgical opening was placed into the tympanic membrane, instillations may be used; however, caution must be taken to prevent debris from being introduced into the middle

or inner ear. Medications administered via the ear come prepared as drops or medicated wicks.

Ear Drops

Liquid solutions that are injected into the ear canal are known as **ear drops** (Figure 14.8). Some ear drops are available over the counter, whereas others require a prescription. Ear drops are used to treat ear infections, ear pain, swimmer's ear, and excessive earwax. Examples of ear drops include ciprofloxacin otic solution (Cetraxal) and ofloxacin otic solution (Floxin Otic). Ear drops should be administered at room temperature. Drops that are too warm or too cool may cause the patient discomfort, dizziness, vertigo, or nausea. Contraindications for ear drops include a ruptured eardrum, unless otherwise noted by the provider, because the opening in the eardrum may allow medication to pass into the middle ear.

FIGURE 14.8 Ear drop packaging must be carefully observed because it is similar in appearance to eye drop and super glue packaging. (credit: Robyn Alvarez)

Medicated Ear Wicks

Small cellulose wicks (Otowick) used when the ear is severely swollen or infected are known as **medicated ear wicks** (Figure 14.9). The wick is placed in the ear canal, with the outer portion of the wick visible at the entrance of the ear canal. The medication is then applied to the end of the wick. When moistened, the wick expands to the size of the ear canal, dispersing the medication throughout the ear. Ear wicks may typically be removed within a few days, after the ear swelling has subsided.

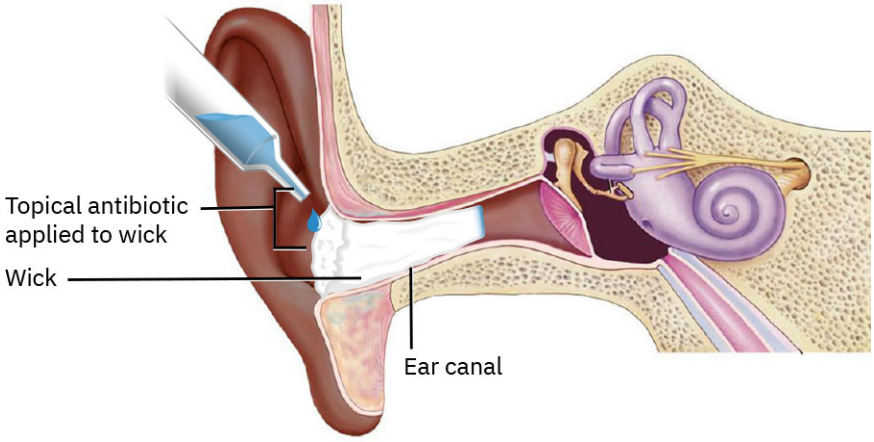

FIGURE 14.9 The provider applies the medication directly to the ear wick. (credit: NIH/NIDCD, Public Domain)

Purpose of Performing Ear Irrigation

Washing out the ear with a continuous flow of liquid or medication, **ear irrigation**, may be warranted to remove foreign objects or wax buildup from the ear canal. Removing these unwanted substances helps minimize the risk of damage to the ear and hearing loss. Side effects of ear irrigations include dizziness, pain, nausea, and ringing in the ears. Ear irrigations should not be performed on patients with damaged eardrums, tubes in their ears, or an active infection in their ear canal. Risks of ear irrigation include ear infections, perforated eardrum, vertigo, and hearing loss.

REAL RN STORIES

Common Side Effects When Performing Ear Irrigation

Nurse: Eliza
Clinical setting: Outpatient family medical practice
Years in practice: 13
Facility location: Portland, Oregon

I had been working as an RN in a busy primary care clinic for several years, and ear irrigation was a common procedure that I frequently performed. One particular day, I had a patient who came in complaining of severe ear discomfort and hearing loss in the right ear. She mentioned she had tried over-the-counter earwax removal drops, but they didn't seem to help. I gathered the necessary equipment, including an otoscope to examine the ear and warm water for the irrigation. I carefully examined her ear using the otoscope and confirmed the presence of a significant earwax blockage. As I began the irrigation, I positioned a kidney basin under the patient's ear to catch the water and dislodged earwax, and then I used a bulb syringe to introduce the warm water gently into the ear canal, being cautious not to insert it too deeply. She described the sensation as a "strange" but not uncomfortable feeling as the warm water flowed into her ear.

Slowly but surely, small pieces of earwax started to emerge from the ear canal. After about five to ten minutes of irrigation, the patient starting to complain of being dizzy and lightheaded. I stopped the irrigation and assisted the patient in lying back on the exam table. While the patient was lying down, I looked in the ear canal to see if the eardrum had ruptured. Thankfully, it had not. After about five to ten minutes, I assisted the patient to a sitting position; however, the patient complained of continued dizziness. We were unable to continue the ear irrigation that day and a family member was called to drive the patient home. She came back a few weeks later to continue the procedure and we were able to successfully remove the rest of the wax then.

Ear Irrigation Solutions and Procedure

Before performing ear irrigation, the provider should assess the ear using an **otoscope** (Figure 14.10), a tool that shines light into the ear and helps to visualize objects or quantify the amount of wax in the ear. Typically, normal saline is used; although, a mixture of saline and hydrogen peroxide also may be used. A 60 mL needleless syringe typically is used to squirt the solution into the ear. A spray bottle with a soft angiocatheter also may be used. The solution should be at room temperature to reduce vertigo, dizziness, and discomfort for the patient.

FIGURE 14.10 The healthcare provider is using an otoscope to assess the ear of an adult patient. (credit: "U.S. Naval Hospital Naples Offers Back to School Physicals, COVID-19 Vaccine" by Tia Nichole McMillen from DVIDS, Public Domain)

Instruct the patient to sit upright and place a towel over their shoulder on the affected side. Draw up the irrigant in the syringe. Hold the irrigation basin next to the ear to collect the irrigant as it runs out of the ear. Gently pull the ear upward and back to allow the irrigant to enter the ear more easily. If irrigating the ear of a pediatric patient, gently pull the ear downward and back. Place the syringe or catheter into the ear, pointing away from the tympanic membrane. Directing the irrigant toward the tympanic membrane may cause perforation. Slowly and gently instill the irrigant (Figure 14.11). Injecting the irrigant too rapidly increases the risk of trauma, bleeding, and pain. After the irrigation is complete, the provider may use a cerumen scoop to remove any remaining wax or particles left in the ear. Place a cotton ball loosely in the ear to absorb any excess irrigant and instruct the patient to lie on their side toward the affected ear to allow the irrigant to completely drain from the ear.

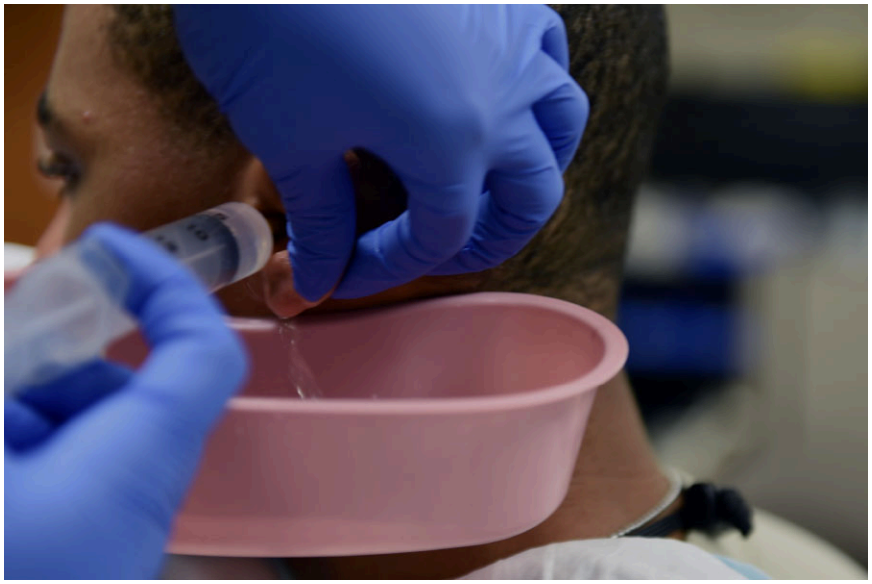

FIGURE 14.11 It is helpful to have the patient or another staff member hold the irrigation basin when performing an ear irrigation. (credit: "Ear Irrigation to Remove Cerumen Impaction" by National Library of Medicine, Public Domain)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Irrigating a Patient's Ear

See the competency checklist for Irrigating a Patient's Ear. You can find the checklists on the Student resources tab of your book page on openstax.org.

Irrigation of the ear has the potential to cause several complications (e.g., otitis externa, vertigo, perforation of the tympanic membrane, middle ear damage). Signs of complications include sudden pain, ringing in the ears, hearing loss, nausea, and dizziness. If any of these symptoms present, stop the irrigation and examine the ear canal with an otoscope. Assess the ear canal for presence of a foreign body, edema, signs of infection, or injury (such as a ruptured eardrum).

CLINICAL JUDGMENT MEASUREMENT MODEL

Prioritize Hypotheses: Recognizing Potential Complications during Ear Irrigations

The nurse is performing an ear irrigation on a patient. While performing the irrigation, the patient begins to complain of ear pain and dizziness. After *recognizing cues* of potential complications (e.g., sudden pain, ringing in the ears, hearing loss, nausea, dizziness), the nurse *analyzes cues* and stops the irrigation until a hypothesis is formed. The nurse considers factors that may result in the identified cues and *formulates a hypothesis* regarding potential causes: perforation of the tympanic membrane, middle ear damage, the irrigant may be too hot or too cold, or the irrigant may have been instilled too rapidly. The nurse uses an otoscope to assess the ear canal to further refine and *prioritize the hypothesis*. The nurse *generates solutions* upon which to *take action*. For instance, if the eardrum appears ruptured, the nurse should contact the healthcare provider and document the patient's response and the action taken. If the ear canal appears within normal limits, the patient may need to lie down for a few minutes until the symptom resolves before continuing with the irrigation. The nurse should also assess the temperature of the irrigation solution to ensure that it is neither too hot nor too cold.]

Procedural Steps for Ear Medication Administration

When administering ear medications, it is important to confirm the rights of medication administration, including the number of drops to be administered and the ear in which the drops should be placed. Abbreviations used for ear instillations include right ear (AD), left ear (AS), and both ears (AU). Ensure the medication is labeled for otic use and check the expiration date.

Before administering ear medications, wash your hands and don gloves to prevent contamination. Instruct the patient to lie on the side opposite the affected ear. Using a warm wet washcloth, clean the external ear of any debris. Ensure the medication is at room temperature. Remove the medication cap and place it on a clean surface to prevent contamination of the inside of the cap or the dropper tip. Straighten the patient's ear canal to prepare the ear for instillation. For an adult, pull the auricle up and back. For a pediatric patient, pull the auricle down and back (Figure 14.12). The ears of pediatric patients are shorter and have a more horizontal angle; hence, they require you to pull the auricle at a different angle.

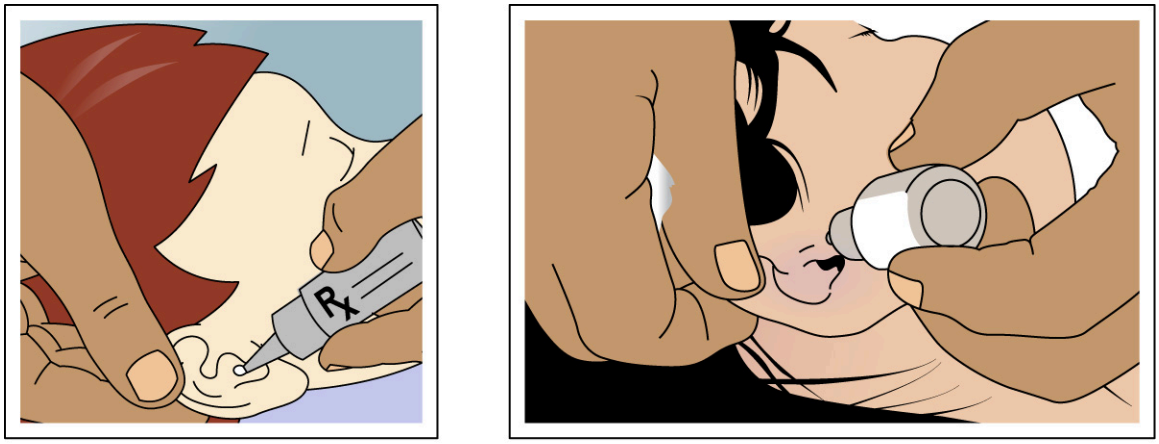

FIGURE 14.12 When administering ear medications, (a) pull the auricle down and back for children or (b) up and back for adults. (attribution a and b: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Aim the bottle toward the side of the auditory canal and gently squeeze the bottle, using caution not to squeeze the medication directly onto the tympanic membrane. Release the auricle and massage the **tragus** (the small piece of thick, skin-covered cartilage in front of the meatus of the external ear immediately in front of the ear canal) to help move the medication toward the tympanic membrane. Instruct the patient to continue lying on their side for five minutes to allow the medication to continue flowing toward the inner ear. After five minutes, the patient may turn to the other side and repeat the ear drops in the other ear, according to the provider's orders. Remove gloves and perform hand hygiene after administering ear medications and assess for common side effects (e.g., dizziness, nausea). Document administration of the medication as well as the patient's tolerance of the medication and procedure.

LINK TO LEARNING

Watch this demonstrational video about ear medications (https://openstax.org/r/77earmeds) to learn how to administer them.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Instilling Eardrops

See the competency checklist for Instilling Eardrops. You can find the checklists on the Student resources tab of your book page on openstax.org.

14.3 Administering Nasal Medications

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify different forms of nasal medications
- Describe categories of nasal inhalation medications
- Describe procedural steps for nasal medication administration

Allergies, sinus infections, and nasal congestion are typically treated by **nasal** medications, which are administered via the nose (i.e., nostrils, external or anterior nares). The absorption surface area of the nasal cavity is large and has high vascularization and permeability; therefore, typically medications are absorbed faster via the nasal passage then the oral route. Medications administered via the nasal route come in a variety of forms and belong to several different categories of medications. Although the nose is not a sterile cavity, asepsis is required to safeguard the connection to the sinuses. It is important for the nurse to understand the indications for use and procedural steps required to safely administer nasal medications.

Forms of Nasal Instillations

Medications administered via the nasal passage come prepared in a variety of forms, including powders, sprays, and washes. The nose has a large mucosal surface area and is highly vascular; therefore, medications administered via the nasal route are absorbed rapidly into the systemic system. As such, it is important to understand how nasal medications are packaged to ensure the right amount of the medication is safely administered.

Nasal Powders

Nasal powders come prepared as a powder inside a device that is used to spray the powder into the nose. Nasal powder formulations benefit from enhanced bioavailability and drug absorption, reduction in the need for preservatives, and allowance for larger doses of medication to be administered than liquid preparations. Examples of nasal powders include glucagon nasal powder (Baqsimi), which is used to treat hypoglycemia (very low blood sugar), and sumatriptan nasal powder (Onzetra Xsail), which is used to treat migraine headaches.

Nasal Sprays

Nasal sprays come prepared as a liquid inside a device that sprays the liquid into the nose. Nasal sprays are indicated for the nasal route and should never be sprayed into the eyes or mouth. Nasal sprays are only used on a single patient to reduce the risk of contamination. Each spray contains one dose of the medication. It is important to note how many sprays are ordered and if they are to be administered in one or both nostrils. Before using a nasal spray for the first time, it is important to prime the pump. To do so, pump the spray bottle several times until you see the medication mist from the bottle (Figure 14.13). Examples of nasal sprays include fluticasone propionate nasal spray (Flonase) and oxymetazoline nasal spray (Afrin).

FIGURE 14.13 The nurse is priming the nasal spray before administering the first dose by pumping the spray bottle several times until the medication mists from the bottle. (credit: "Action photo of nasal spray on a black background" by robin_29, CC BY 2.0)

PATIENT CONVERSATIONS

Educating a Patient on Nasal Sprays

Nurse: Mr. Floyd, your provider has sent in a prescription for a nasal spray. Have you ever taken a nasal spray before?

Patient: No, I've never taken a nasal spray before.

Nurse: Nasal sprays are liquid medications that you inhale through your nose. Each spray of the medication is equal to one dose of the medication.

Patient: How many sprays I am supposed to take?

Nurse: Your provider has ordered that once a day you do one spray in each side of your nose, which are called the nostrils.

Patient: How do I use it?

Nurse: Before using the nasal spray for the first time, you will prime the medication bottle. To do this, pump the spray bottle several times until you see the medication mist from the bottle. After you see the mist, it is primed and ready to use. Before you take the medication, blow your nose. Then, you tilt your head backward and insert the tip of the spray bottle in one side of your nose. Position the bottle so the tip is aimed toward the ear located on the same

side as that nostril. Using your other hand, press down on the other side of your nose. While the other side of your nose is blocked, press down on the spray applicator while you inhale. Hold your breath for a few seconds and then exhale. Then, do it again on the other side. Try to avoid blowing your nose for five to ten minutes after administration so you do not blow the medication out.

Patient: Okay, I understand.

Nurse: Mr. Floyd, can you show me which way you will point the tip of the medication bottle after you put it in your nose?

Patient: If it is going in the right side, I point it toward the right ear. If it is going in the left side, I point it toward the left ear.

Nurse: You are correct! What questions do you have about how to use the nasal spray?

Patient: I do not have any questions at this time.

Nasal Washes

Nasal irrigation, also known as **anasal wash**, help to clean mucus, allergens, irritants, bacteria, and viruses from the nose. Nasal irrigation decreases swelling in the nose, increases airflow, decreases the risk of infection, and enhances the effectiveness of medications. When performing a nasal wash, a saline solution of distilled or sterilized water is used. Tap and well water should not be used because of the risk of introducing bacteria into the sinus cavity. While leaning over a sink, the patient squirts the solution into one nostril, rinses the sinus cavity, and allows the solution to come out of the other nostril (Figure 14.14). A variety of techniques may be used, including a sinus rinse kit, bulb syringe, or neti pot. To prevent bacterial growth, it is important to clean the nasal wash equipment after each use. To prevent cross contamination, the nasal wash equipment is intended only for a single patient.

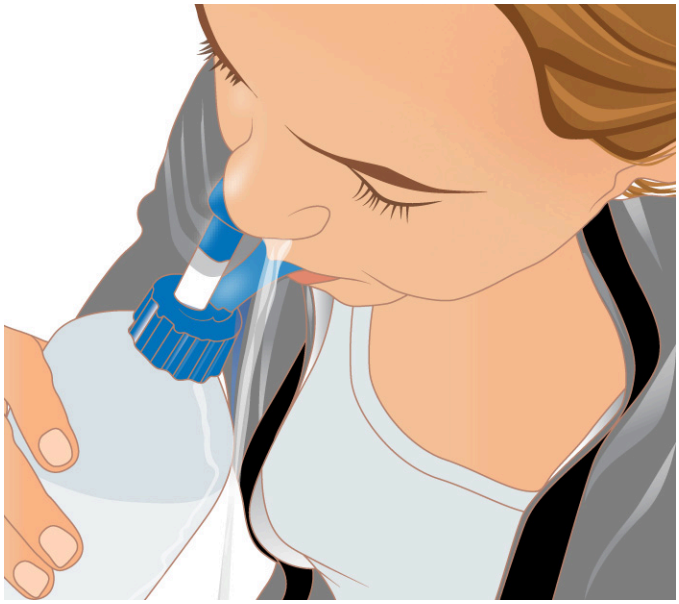

FIGURE 14.14 When performing a nasal wash, the solution should flow freely from the opposite nostril. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Categories of Nasal Inhalation Medications

Medications may also be administered using a nasal inhaler to deliver medication to the respiratory tract. The mucosal lining of the respiratory tract rapidly absorbs the medication, producing both local and systemic effects. Consistent use of nasal medications of any kind has the potential to injure the nasal tissue and affect the sense of smell. Categories of nasal inhalation medications include the following:

- Antihistamines relieve symptoms of allergies.
- Steroids reduce inflammation.
- Decongestants provide relief of nasal congestion.

- Mast cell inhibitors treat allergic symptoms by blocking mast cells.
- Anticholinergics block the action of acetylcholine.
- Opioid antagonists reverse opioid overdoses.

Antihistamines

Nasal antihistamine sprays are commonly prescribed to treat allergy symptoms, such as congestion, itchiness, runny nose, and sneezing. They work by blocking the effects of histamine. Typically, they cause less drowsiness than oral antihistamines. Examples of nasal antihistamine sprays include azelastine nasal (Astelin) and olopatadine nasal (Patanase).

Steroids

Allergy symptoms, such as congestion, sneezing, and itchy, watery eyes are often treated by steroid nasal sprays. They work by reducing inflammation within the nasal cavity. Unlike antihistamines and decongestants, steroids typically take approximately a week to begin relieving symptoms. Side effects of nasal steroid sprays include headache, sore throat, cough, and nosebleeds. Steroid sprays are available by prescription, as well as over the counter. Examples of prescription steroid sprays include beclomethasone nasal (Beconase) and fluticasone nasal (Veramyst). Examples of over-the-counter steroid sprays include budesonide nasal (Rhinocort Allergy) and triamcinolone nasal (Nasacort 24 hour).

Decongestants

Over-the-counter medications like **decongestant** sprays are also used to treat allergy symptoms. They work by causing the blood vessels and tissues in the nose to shrink, thereby relieving nasal congestion. Nasal decongestants should not be used for longer than three days because doing so may inadvertently cause increased congestion, also called *rebound congestion*. Other potential side effects include nasal dryness and irritation, nasal bleeding, headache, increased heart rate and blood pressure, nervousness or restlessness, and difficulty sleeping. Typically, decongestant sprays are not advised for patients with uncontrolled high blood pressure or glaucoma, as nasal decongestants cause narrowing of the blood vessels, which may further increase the blood pressure and cause increased ocular pressure that can potentially cause the glaucoma to worsen. Examples of nasal decongestants include oxymetazoline nasal (Afrin) and phenylephrine nasal (Neo-Synephrine).

Mast Cell Inhibitors

Allergy symptoms can be relieved by **mast cell inhibitors**, which stabilize mast cells. Mast cells release histamines; therefore, stabilizing mast cells blocks histamine release. Mast cell inhibitors block histamine release, so they are most effective if taken one to two weeks before allergy season begins. Side effects of mast cell inhibitors include headache, unpleasant taste, hoarseness, nosebleeds, and temporary nasal stinging. An example of a mast cell inhibitor spray is cromolyn sodium (NasalCrom), which can be purchased over the counter without a prescription.

Anticholinergics

Symptoms of a runny nose can be treated by **anticholinergic** sprays. They block acetylcholine in the nose to dry up extra mucus. Anticholinergics can be used for approximately three weeks and are not intended for long-term use. Common side effects include dry mouth, nasal irritation, headache, nosebleeds, and unpleasant taste in the mouth. Patients with glaucoma or enlarged prostates may be advised to avoid this medication; these medications can lead to increased intraocular pressure that may worsen glaucoma or cause urinary retention due to relaxation of the bladder. Currently, the only anticholinergic spray available is ipratropium inhalation (Atrovent), which is available by prescription only.

Opioid Antagonists

Opioid overdose and reversal of respiratory depression associated with opioid use are often treated by **opioid antagonists**. These work by blocking one or more of the opioid receptors in the central or peripheral nervous system. Each dose of opioid antagonist spray includes one dose of medication and should be used only once. Common side effects include headache, nasal dryness, nasal swelling, congestion, and muscle pain. An example of an opioid antagonist available in a nasal spray is naloxone (Narcan) (Figure 14.15).

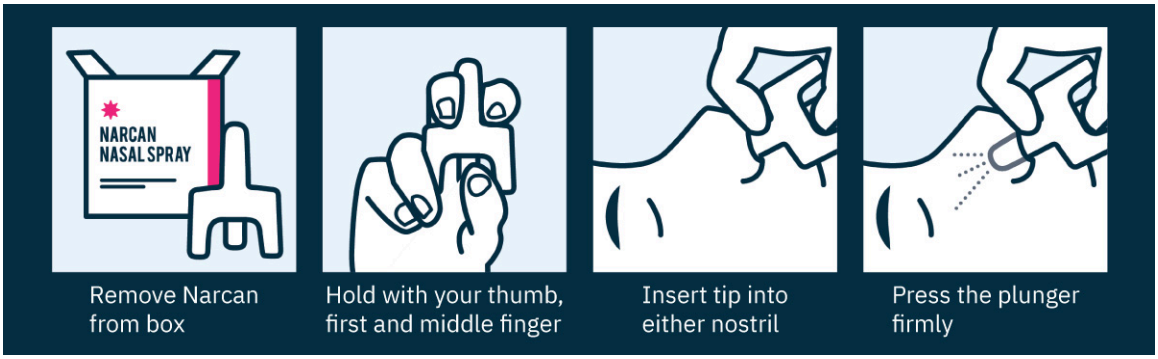

FIGURE 14.15 To administer nasal naloxone (Narcan), place the nozzle in the nostril and press the plunger all the way up. (credit: "How to Administer Narcan" by Oshkosh Public Health & WIC, Public Domain)

Procedural Steps for Nasal Medication Administration

Nasal instillations should be administered via the nasal passage using a clean technique. The nurse should perform hand hygiene, don gloves, and perform the same rights of medication administration as is completed with other types of medications. The patient should be given tissues and asked to blow their nose. Position the patient so they are either sitting with their head tilted backward or lying supine looking upward. The nurse should insert the tip of the spray bottle or the nasal dropper into one nostril while occluding the other nostril and then activate the spray as the patient inhales. When administering a nasal spray, direct the spray away from the nasal septum to reduce potential irritation and allow the full dose of medication to take effect (Figure 14.16). The bottle should remain compressed as it is removed from the nose to prevent contamination. The patient should be instructed to hold their breath for a few seconds and then breathe through their mouth. Repeat this procedure in the other nostril, if ordered. Wipe the outside of the bottle with clean tissue before storing it and advise the patient to avoid blowing their nose for five to ten minutes after nasal instillation. Perform hand hygiene and note any unexpected situations, such as nosebleeds or increased congestion. Document administration of the medication as well as the patient's tolerance of the medication and procedure.

FIGURE 14.16 When administering nasal medication, aim the nasal medication bottle toward the ear, away from the septum. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LINK TO LEARNING

Watch this demonstrational video about nasal medications (https://openstax.org/r/77nasalmeds) to learn how to administer them.

14.4 Administering Inhaled Medications

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the different forms of inhaled medications
- Understand the categories of inhaled medications
- Verbalize procedural steps for administering inhaled medications

Medications administered through inhalation are dispersed via an aerosol spray, mist, or powder that patients inhale into their airways. Although the primary effect of inhaled medications is respiratory, there are likely to be systemic effects as well. Inhaled medications are absorbed easily by the lungs because of the large surface area of the lungs with high blood flow. Therefore, inhaled medications work faster than oral medications. Medications may be inhaled into the respiratory tract to reduce inflammation in the airways, open the lungs, and treat a variety of respiratory illnesses.

Forms of Inhaled Medications

Inhaled medications may be administered by nebulizers or hand atomizers. Although both forms of inhaled medications are used to deliver medications into the lungs to treat respiratory conditions, the selected form may depend on several factors. Hand atomizers tend to be smaller and more portable than nebulizers; however, nebulizers may be the preferred option for patients who experience difficulty in coordinating and controlling their breaths.

Nebulizer

A **nebulizer** is a small electric or battery-powered machine that delivers a fine mist of liquid medications (Figure 14.17). Oxygen or compressed air is used to transfer the medication from the nebulizer and into the lungs via a face mask or mouthpiece. The oxygen or compressed air moves the particles, so the patient may be instructed to breathe normally during nebulized medication administration. To reduce the risk of bacteria, nebulizers should be cleaned after each use, disinfected at least once per week, and left out to air-dry after cleaning. Medications, such as **bronchodilators** (medication that relaxes the muscles in the lungs and widens the airway) and antibiotics, may be administered via a nebulizer. Steroids cannot be administered via a nebulizer and require an inhaler. When administering medications via nebulizers, monitor the patient's heart rate throughout the treatment because these medications may cause tachycardia or other cardiac effects, such as palpitations or irregular heart rhythms.

FIGURE 14.17 This mannequin is wearing a face mask with an attached nebulizer, which is used to deliver inhaled medications. (credit: British Columbia Institute of Technology, CC BY 4.0)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering a Nebulizer Treatment

See the competency checklist for Administering a Nebulizer Treatment. You can find the checklists on the Student resources tab of your book page on openstax.org.

LIFE-STAGE CONTEXT

Administering Nebulizers to Children and Older Adults

Nebulizers are often recommended for administering inhalation medications to children and older adults because nebulizers do not require coordination of breathing and administration efforts. Although typically a mouthpiece is more efficient for delivering nebulized medications, a face mask should be used with young children and older adults. Face masks are easier to use with these populations because these patients often have difficulty keeping nebulizer mouthpieces in their mouths. It is important to ensure the patient keeps the mask on for the duration of the treatment. Giving the patient something to do, such as reading a book, playing with a toy, or reading the newspaper, can be very beneficial for keeping children and older adults occupied and helping them remain still throughout the nebulizer treatment.

Though nebulizers take time to set up, they can be more effective to use during asthma attacks because the medication is pressurized into the lungs versus requiring a deep breath to inhale the medication into the lungs. Nebulizers may also be easier to use with young children because instructions for teaching the child how to breathe during the medication administration are not required. Another benefit of nebulizers is that multiple medications may be delivered simultaneously. Although nebulizers can be very beneficial, they are not as easy as an inhaler to transport, often require a power source, and take longer to administer the medication than when administered through an inhaler.

PATIENT CONVERSATIONS

Educating a Child on Nebulizers

Nurse: Good morning. My name is Nurse Sarah and I'm here to help you with your nebulizer treatment today. What's your name?

Child: Hi, Nurse Sarah. I'm Emily.

Nurse: It is nice to meet you, Emily. How are you feeling today?

Child: I'm okay, but my chest feels a little tight.

Nurse: I'm sorry to hear that. It's great that you're here so we can help you feel better. Do you know what a nebulizer is, Emily?

Child: Yeah, my mom told me it's a machine that will help me breathe better.

Nurse: That's right! It's like magic mist that helps open up your airways. It's a bit noisy, but it's not scary. Now, let's get everything ready. I am going to turn on the machine and it will turn the medicine into a mist that you'll breathe in through this mask.

Child: Okay, but will it taste bad?

Nurse: It might have a slightly funny taste, but it's not too bad. You can think of it as a special potion that will help you breathe better. Plus, you can drink some water afterward if you like.

Child: Okay, I can do that.

Nurse: I am going to put the mask on you, and you just need to sit back, relax, and take slow, deep breaths. You can watch your favorite show, read a book, or even close your eyes and imagine a fun adventure.

Child: Can I pretend I'm a dragon breathing fire?

Nurse: Absolutely! That sounds like a fantastic adventure. You can be a dragon while you take your treatment.

Scenario follow-up: Emily puts on the mask, and Nurse Sarah starts the nebulizer machine. Emily continues her nebulizer treatment, imagining herself as a dragon, while Nurse Sarah keeps an eye on her and offers reassurance throughout the process.

Hand Atomizer

A **hand atomizer** (**inhaler**) is a pocket-sized device that delivers medications into the lungs without the use of electricity. There are three main types of hand atomizers: metered-dose inhalers, dry powdered inhalers, and soft-mist inhalers. To prevent bacterial growth, inhalers should be cleaned frequently. Most inhalers track the number of doses administered, allowing for medication refills to be obtained before running out of the medication.

Metered-Dose Inhaler (MDI)

A **metered-dose inhaler (MDI)** creates an aerosolized mist of medication that is inhaled through the mouth and into the lungs (Figure 14.18). The canister is attached to a mouthpiece and the medication is administered into the lungs by pressing on the canister while coordinating breathing efforts. Medication waste is common with MDIs because mist particles stick to the tongue or aerosolize in the air. MDIs may be used for steroids, bronchodilators, and combination medications. Examples of MDIs include albuterol inhalation (ProAir HFA) and fluticasone inhalation (Flovent).

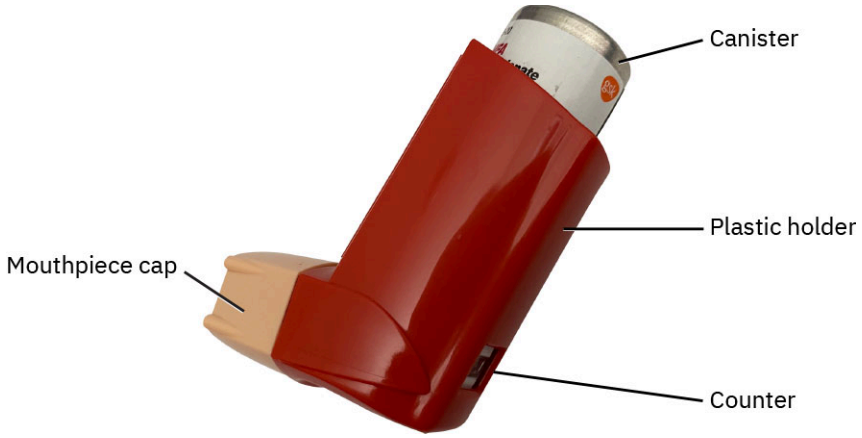

FIGURE 14.18 Metered-dose inhalers (MDIs) consist of a medication canister, plastic holder, and mouthpiece cap. Some MDIs also include a counter that indicates the number of doses remaining. (credit: donated by Carol Clarkson)

A **spacer** may be used to prevent waste of medication and allow for the full dose to be administered (Figure 14.19). A spacer is a clear tube that fits between the inhaler and the mouthpiece. After the medication is released from the inhaler, it moves into the spacer, which allows the patient to inhale the medication more slowly and with control. The spacer must be cleaned frequently to prevent bacterial growth.

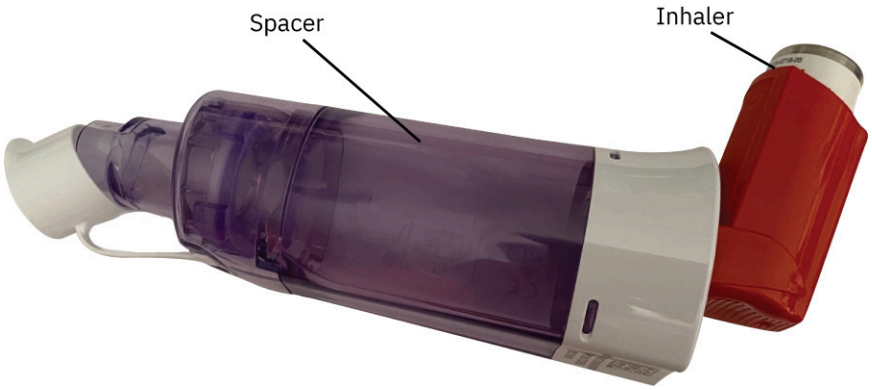

FIGURE 14.19 A spacer allows for more controlled administration of medication from MDIs. (credit: donated by Carol Clarkson)

Dry Powder Inhalers (DPI)

A **dry powder inhaler (DPI)** provides dry powder medications that are inhaled through a device in the mouth and into the lungs (Figure 14.20). Unlike MDIs, DPIs use an inward breath to move the medications into the lungs instead of a propellant. After the dose is activated, a quick inhale activates the medication and moves it into the lungs. Typically, DPIs are easy to use, do not require a spacer, and do not require the same coordinated efforts in breathing and operating the device as MDIs. Unlike MDIs, DPIs require more forceful breaths, are more difficult to receive an exact dose of medication, and can be affected by humidity. Examples of DPI mediations include budesonide inhalation suspension (Pulmicort) and fluticasone-salmeterol inhalation powder (Advair Diskus). Patients should be instructed to rinse their mouth, spitting out the rinse, after use of a DPI to reduce the risk of oral thrush (fungal infection), local side effects (such as throat irritation, dry mouth, and hoarseness), and to prevent unintentional swallowing of the medication particles.

FIGURE 14.20 The dry powder is contained in a capsule that is placed inside the DPI. The DPI is closed and the capsule is broken open inside so the user can inhale the powder. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Soft-Mist Inhaler

A **soft-mist inhaler** is a handheld device that turns liquid medications into a mist cloud that can then be inhaled without a propellant. The medication contains more particles and leaves the inhaler more slowly than with MDIs or

DPIs; therefore, more of the medication enters the lungs and a lower dose of the medication may be used. This type of inhaler does not require coordinated breathing efforts or a spacer. An example of soft-mist inhaler medication is tiotropium/olodaterol (Stiolto Respimat).

Categories of Inhaled Medications

There are several categories of inhaled medications, including bronchodilators, steroids, antibiotics, and dornase alfa, an inhaled medication made of synthetic proteins used to treat cystic fibrosis (CF). The category of inhaled medication prescribed is dependent on factors such as the patient's condition, severity of symptoms, and potential side effects. It is important for the nurse to understand the various categories of inhaled medications, their indications, how they work, and potential side effects.

Bronchodilators

A bronchodilator is a medication that relaxes the muscles in the lungs and widens the airways. Bronchodilators are used to treat long-term conditions (e.g., asthma, chronic obstructive pulmonary disease [COPD]) in which the airways become narrower and more inflamed. Bronchodilators may be short-acting (i.e., unexpected attacks of breathlessness) or long-acting (i.e., to help control breathlessness) in asthma and COPD. Potential side effects of bronchodilators include trembling in the hands, headaches, dry mouth, heart palpitations, muscle cramps, cough, diarrhea, or nausea and vomiting.

The most widely used bronchodilators for inhalation are beta-2 agonists and anticholinergics. Beta-2 agonists stimulate beta-2 receptors in the muscles that line the airways, causing them to relax and dilate. These medications should be used with caution for patients that have hyperthyroidism, cardiovascular disease, arrhythmias, hypertension, or diabetes, as the symptoms of these conditions may worsen. For example, bronchodilators can stimulate the sympathetic nervous system, which may lead to increased heart rate, increased blood pressure, chest pain, and an irregular heart rate. They can also stimulate the liver to release glucose, which increases the blood glucose levels. Examples of beta-2 agonists include salbutamol (Ventolin) and vilanterol (Breo Ellipta). Anticholinergics dilate the airways by blocking the cholinergic nerves. These medications should be used with caution for patients who have benign prostatic hyperplasia (BPH), bladder obstruction, or glaucoma. For example, anticholinergics can worsen the symptoms of BPH and bladder obstruction by relaxing the bladder muscles, causing urinary retention. These medications can also cause the pupil to dilate, thereby increasing intraocular pressure and worsening glaucoma. Examples of anticholinergics include ipratropium inhalation (Atrovent) and glycopyrronium (Qbrexza).

Steroids

A steroid is an anti-inflammatory medication. A **corticosteroid** is a medicine that reduces inflammation and prevents flare-ups of respiratory conditions. Corticosteroids are the gold standard treatment for asthma and may be taken in combination with bronchodilators to help keep the airways open and enhance the effectiveness of the corticosteroids. People taking inhaled steroid medications should be instructed to brush their teeth or rinse their mouth with water after administering the medication to decrease the risk of fungal infections. It is important they do not swallow the rinse water because doing so may cause a fungal infection in the throat. Examples of steroid inhalation medications include beclomethasone inhalation (Beclovent) and fluticasone inhalation (Flovent). Potential side effects of steroid inhalers include a sore mouth or throat, hoarse voice, cough, or oral thrush.

Antibiotics

Antibiotics may be warranted for patients with chronic respiratory diseases, such as CF, non-CF bronchiectasis (a chronic condition where the lung walls are thickened due to inflammation and infection), and ventilator-associated pneumonia. Inhaled antibiotics have the potential to deliver higher concentrations of medications without the systemic effects of oral or parenteral administration. Examples of inhaled antibiotics include aztreonam (Azactam) and tobramycin inhalation powder (Tobi Podhaler). Potential side effects of inhaled antibiotics include new or worsening breathing problems, ringing in the ears, hoarse voice, dizziness or balance problems, muscle weakness, or kidney problems.

Dornase alfa

An inhaled medication consisting of a synthetic protein that breaks down excess DNA in the pulmonary secretions of people with CF is known as **dornase alfa** (Pulmozyme). They help to improve the lung function and lower the risk of

infection by thinning the mucus in the airways. Dornase alfa is inhaled via a nebulizing device that creates a mist from the liquid medication. It must be kept in the refrigerator, protected from sunlight, and discarded after it is opened. This medication is stored in foil pouches to protect it from sunlight and should not be left at room temperature for longer than twenty-four hours. No other medications should be mixed with dornase alfa during the nebulizing treatment. Potential side effects of dornase alfa include loss of voice, throat discomfort, red or watery eyes, rash, runny nose, shortness of breath, fever, chest pain, indigestion, or diminished lung function.

Procedural Steps for Administering Inhaled Medications

Regardless of the type of inhaled medication, the nurse should perform hand hygiene, apply gloves, and perform the same rights of medication administration as is completed with other types of medications. Perform and document a respiratory assessment, including respiratory rate, oxygen saturation level, heart rate, lung sounds, and respiratory effort.

To administer nebulizers, pour the liquid medication into the medication cup of the nebulizer. Sit the patient in high Fowler's position with the head of the bed elevated between 60 and 90 degrees, if possible. Attach the nebulizer to an oxygen set with a flow rate of 6 to 10 L/min, based on the manufacturer's guidelines. Check for misting to ensure the equipment is working properly. Attach the top end of the tubing to the nebulizer mask. Instruct the patient to take slow, deep breaths through their mouth, pausing for two to three seconds before each exhale. If the patient is dyspneic, encourage them to hold their breath every fourth or fifth breath for five to ten seconds. Instruct the patient to continue the breathing pattern until the medication has been fully administered, as evidenced by no visible misting. Nebulized medications typically take ten to fifteen minutes to administer. After the treatment is completed, turn off the oxygen flowmeter, unless the patient is receiving oxygen therapy, and disconnect the nebulizer. After administration, encourage the patient to cough and breathe deeply and perform oral care. The nurse should then re-evaluate the patient's respiratory system to include respiratory effort. Perform hand hygiene and document administration of the medication as well as the patient's tolerance of the medication and procedure.

LINK TO LEARNING

Watch this demonstrational video about nebulized medications (https://openstax.org/r/77nebulize) to learn how to administer them.

To administer an MDI, shake the inhaler and attach the spacer, if applicable. Have the patient place the mouthpiece of the inhaler or spacer between their lips, while tightly closing their lips around it. If a spacer is not used, the inhaler may be held 1 to 2 in (2.5 to 5 cm) from the mouth. Instruct the patient to breathe out and then press the inhaler down at the same time the patient is breathing in. Instruct the patient to keep breathing in, slowly, for three to five seconds and then hold their breath for five to ten seconds to get the medication into the airways. A slow inhale is required to prevent the medication from hitting the back of the throat instead of moving into the lungs. Slowly breathe out and repeat if more than one puff is required. When administering corticosteroids, instruct the patient to rinse their mouth to prevent fungal infections. Instruct the patient not to swallow the rinse water to prevent fungal infections in the back of the throat. Perform hand hygiene and document administration of the medication as well as the patient's tolerance of the medication and procedure.

LINK TO LEARNING

Watch this demonstrational video about metered-dose inhaler medications (https://openstax.org/r/77inhaler) to learn how to administer them.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Implementing a Spacer

The nurse is caring for an older patient who is taking a metered-dose inhaler. The patient will be discharged with

the inhaler, so the nurse allows the patient to self-administer the medication under nurse supervision. The nurse notices the patient pressing down on the canister and then pausing before inhaling. The nurse *recognizes the cues* that the patient is using an incorrect technique. The nurse *analyzes the cues*, understanding that the patient should begin breathing in while simultaneously pressing down on the medication canister. The nurse *prioritizes the hypotheses* that the delay in breathing is resulting in medication waste and the patient is not receiving the full dose of the medication. The nurse *generates a solution* by recognizing that the patient may benefit from using a spacer and *takes action* by contacting the respiratory department to obtain a spacer that can be used with the next administration of the medication.

To administer dry-powder inhalers, remove or rotate the cap of the inhaler. Load the medication, if applicable, and press down on the lever per manufacturer's guidelines to activate the medication. Instruct the patient to turn their head away from the device and breath all the way out. Place the mouthpiece into the mouth and close their lips around it. Breathe in deeply for a few seconds. Take the device out of the mouth and instruct the patient to hold their breath for up to ten seconds before slowly breathing out. Instruct the patient to rinse their mouth with water or brush their teeth, ensuring they do not swallow the rinse water. Perform hand hygiene and document administration of the medication as well as the patient's tolerance of the medication and procedure.

To administer soft-mist inhalers, prepare the device according to the manufacturer's instructions, open the cap, and instruct the patient to breathe out slowly and fully. The nurse instructs the patient to place the mouthpiece in the mouth, using caution not to cover the air vents on the sides of the device. Press the dose release button while the patient slowly inhales the mist. Instruct the patient to hold their breath for ten seconds and repeat, as prescribed. Perform hand hygiene and document administration of the medication as well as the patient's tolerance of the medication and procedure.

Order of Inhaled Medications

When administering multiple inhaled medications, the order of administration matters. If the patient is ordered a bronchodilator, the bronchodilator should be administered before any other inhaled medication, which relaxes and opens the airway and allows the other medications to work more effectively. Next, administer dornase alfa, if ordered, which breaks up and thins the mucus. After encouraging the patient to cough and breathe deeply to clear the mucus, the antibiotic is the next medication to be inhaled, which kills the bacteria in the lungs. Steroids are administered last, when the lungs are the most cleared, which reduces the swelling that may have been caused by the mucus and infection.

14.5 Administering Other Medications

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe indications for vaginal route of medication administration
- Identify indications for rectal route of medication administration

Other routes of medication administration include per vagina (PV) and per rectum (PR). Medications administered via the **vaginal** or **rectal** route have a faster onset and higher bioavailability than oral medications because they bypass the gastrointestinal tract. Bypassing the the gastrointestinal (GI) tract allows for the avoidance of hepatic first-pass metabolism, which is the initial metabolism and chemical alteration of a drug that takes place in the liver before it enters the bloodstream. Bypassing the GI tract also allows for more of the medication to be absorbed by the body. It also reduces the risk of certain side effects, such as gastric irritation, nausea, and vomiting. This section will discuss common indications for vaginal and rectal medication administration, the various forms of medication preparations, and how to safely administer medications via these routes.

Indications for Vaginal Route of Medication Administration

Vaginal medications are inserted into the vagina. Typically, medications administered via this route are indicated for hormone therapy, antifungal treatment, and contraception. Hormonal therapy may be warranted after menopause or during breastfeeding. Low estrogen levels may cause vaginal dryness and itching, which can be relieved by vaginal medications. Antifungal treatments may be used to treat infections, such as yeast infections and bacterial vaginosis. Spermicides or contraceptive gels may be inserted into the vagina before sexual intercourse as a means

of birth control. Vaginal medications may be used during menstruation cycles; however, tampons should not be used because they will absorb some of the medication and decrease the intended effects of the medication.

PATIENT CONVERSATIONS

Educating a Patient on Vaginal Suppositories

Nurse: Mrs. Safrit, your provider has placed an order for you to start progesterone suppositories.

Patient: Suppositories?

Nurse: Yes, progesterone comes prepared as a vaginal suppository that you can easily insert yourself at home.

Patient: Can't I just take a progesterone pill?

Nurse: Vaginal progesterone suppositories are the most effective delivery method for ensuring your body has the progesterone needed to get, and stay, pregnant. They work by slowly releasing progesterone into the body via the vagina.

Patient: How do I insert it?

Nurse: I have a sample here with me and will show you exactly what to do. You will open the suppository package, remove the suppository from the wrapper, and place the suppository at the end of the applicator. The rounded end of the suppository should be facing out of the applicator. Lubricate the applicator with a water-based lubricant. With your nondominant hand, spread the labia and place the applicator into the full length of the vagina, push the plunger, and then remove the applicator. After you insert it, lie in bed for ten to fifteen minutes to allow time for the suppository to dissolve and absorb into the body. It is recommended that you insert the suppository at night, so it has plenty of time to absorb while you are sleeping.

Patient: That doesn't sound too bad. I think I can do that.

Nurse: I will provide you with a handout with instructions just in case you need a reminder after you get home. If you have any questions when you get home, feel free to send me a message in the patient portal and I will be happy to help.

Forms of Vaginal Medications

Vaginal medications come prepared as creams, foams, suppositories, and tablets. A **cream** is a semisolid emulsion that contains a suspended or dissolved medication. A **foam** is a liquid medication dispersed in gas that results in a light, frothy substance. Creams and foams are squeezed from the medication tube into an applicator that allows for easy insertion into the vagina (Figure 14.21).

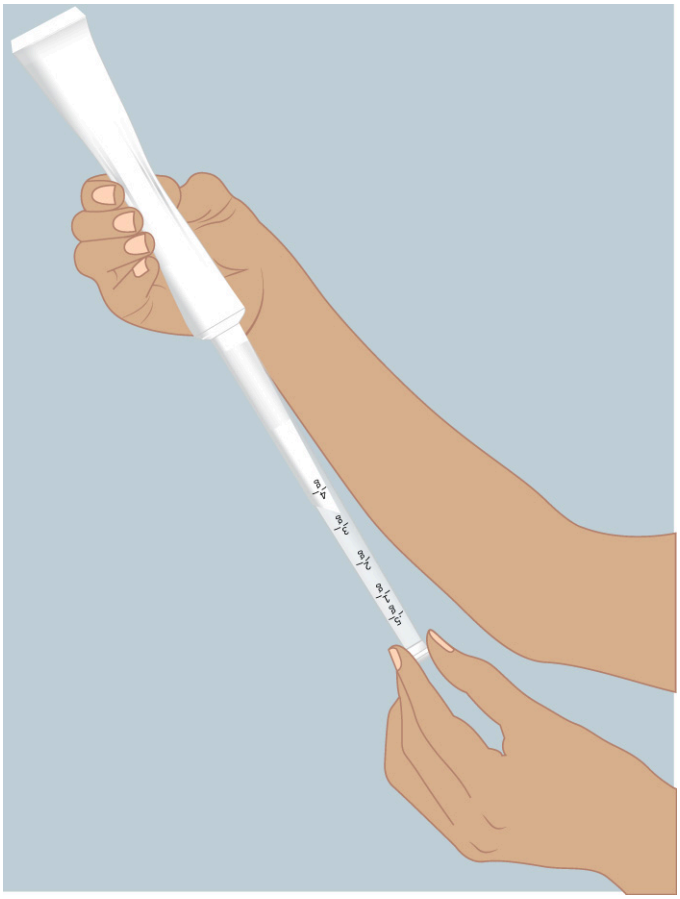

FIGURE 14.21 The patient withdraws the vaginal cream from a medication tube into a vaginal applicator. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Solid medications that melt inside the body and absorb into the bloodstream are known as **suppositories**. They are absorbed quickly and have a faster onset than oral medications. It is important to store suppositories in a cool, dry place to avoid accidental disintegration and melting. Compressed powders that have been formed into a solid are called tablets. Body warmth causes the tablet to disintegrate so that it may be absorbed into the bloodstream (Figure 14.22). Vaginal suppositories and tablets are placed onto the end of an applicator and then inserted into the vagina.

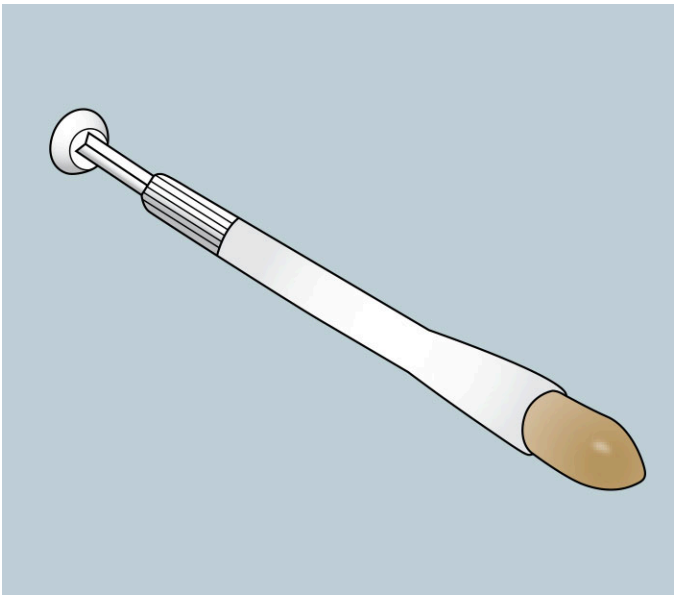

FIGURE 14.22 The patient places a vaginal suppository on the end of an insertion applicator. (attribution: Copyright Rice University,

OpenStax, under CC BY NC-SA 4.0 license)

CULTURAL CONTEXT

Considerations for Male Nurses Administering Vaginal Suppositories

When a male nurse is tasked with administering a vaginal suppository to a female patient, several important considerations must be kept in mind to ensure that the patient's privacy, comfort, and dignity are respected, and that professional and ethical standards are maintained. Some key considerations include the following:

- **Cultural sensitivity**: Be sensitive to the patient's cultural background and beliefs. Some patients may have cultural or religious preferences regarding the gender of healthcare providers involved in intimate procedures. If possible and within the constraints of staffing and patient safety, consider accommodating such preferences.
- **Privacy and dignity:** Ensure that the patient's privacy and dignity are preserved throughout the procedure. This includes providing a private area for the administration of the suppository, using appropriate draping, and ensuring that only necessary personnel are present.
- **Clear communication:** Open and clear communication is crucial. The nurse should explain each step of the procedure to the patient before proceeding, allowing the patient to express any concerns or discomfort.
- **Professionalism:** Maintain a high level of professionalism throughout the procedure. The nurse should focus on the clinical aspects of the task and approach it with empathy and respect.

Procedural Steps for Vaginal Medication Administration

The patient should be asked to void before placement of a vaginal medication. The nurse performs hand hygiene, dons gloves, performs the same rights of medication administration as is completed with other types of medications, and provides patient privacy. Position the patient on their back with knees flexed. The nurse performs perineal care before administering the medication. After perineal care, the nurse removes their gloves, performs hand hygiene, and dons a new pair of gloves.

Fill a vaginal applicator with cream or foam; or open the suppository packaging. Lubricate the applicator or your gloved finger with a water-based lubricant. With the nondominant hand, spread the labia, place the applicator into the full length of the vagina, push the plunger, and then remove the applicator (Figure 14.23). If a suppository is being placed with your finger, insert the rounded end of the suppository with your index finger, placing it along the posterior wall of the vagina. Ask the patient to remain in the supine position for five to ten minutes for optimal absorption. If possible, administer the medication at bedtime so the patient can remain in the supine position for an extended period of time to enhance absorption. Perform hand hygiene and assess the patient for any unexpected situations, such as the suppository coming out. Document administration of the medication as well as the patient's tolerance of the medication and procedure.

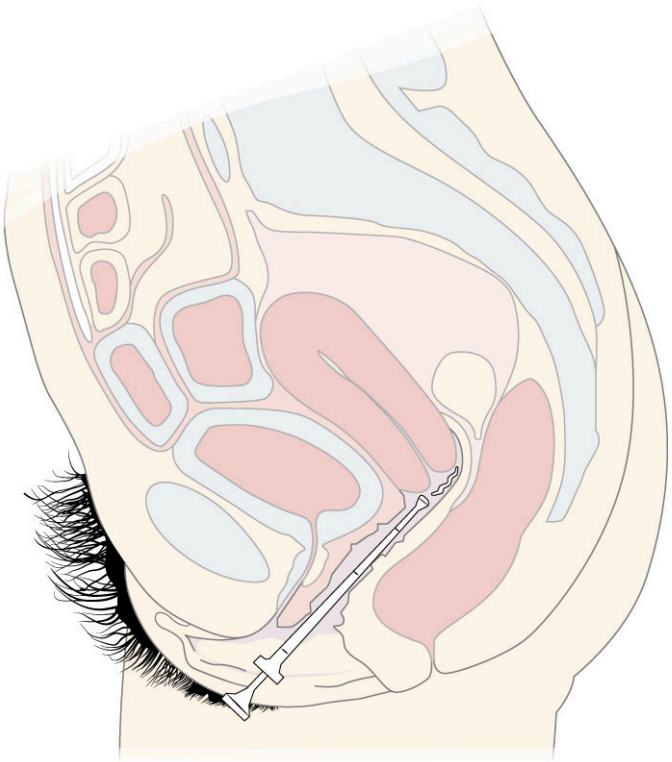

FIGURE 14.23 The filled applicator should be inserted into the full length of the vagina before pushing in the plunger. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Indications for Rectal Route of Medication Administration

Rectal medications are inserted into the rectum. Medications administered via the rectal route may be indicated based on gastrointestinal or systemic effects. For example, laxatives may be indicated to relieve the gastrointestinal symptom of constipation, whereas analgesics may be indicated for systemic pain relief when other medication routes are not available or effective. A potential complication of rectal medication insertion is the potential for bowel perforation. Therefore, rectal medications are contraindicated with rectal bleeding; diarrhea; rectal prolapse; low platelet count; or after rectal, bowel, or prostate surgery. Another potential complication of rectal medication insertion is unintended vagal stimulation that results in bradycardia. Therefore, the rectal route may be contraindicated for patients with certain cardiac conditions.

PATIENT CONVERSATIONS

Administering an Acetaminophen Suppository to Reduce Fever

Scenario: Kathy Plaia is a registered nurse who worked at an outpatient pediatrician office in Savannah, Georgia. One day while working the after-hours nurse triage line, the nurse received a phone call from a parent stating their 5-year-old child, Marcus, had a fever of 101.2°F (38.4°C).

Nurse: I'm sorry to hear Marcus is not feeling well. Is Marcus experiencing any other symptoms besides the fever?

Parent: Yes, Marcus has complained of being nauseous for the past couple of hours. He has thrown up twice and can't keep any liquids down.

Nurse: Since Marcus cannot keep liquids down, I recommend you give him a 120 mg acetaminophen (Tylenol) suppository. The suppository will be inserted into his rectum; therefore, he can't throw it up as he would an oral tablet.

Parent: A suppository? Like put something in his bottom? Oh, I'm not sure I can do that.

Nurse: I will walk you through the process and hopefully it will help Marcus to feel better.

Parent: Well, okay. If it will make my child better, I will try it.

Nurse: Wonderful! Tylenol suppositories can be found at your local pharmacy or grocery store. Go to the medication aisle and it will be where the regular Tylenol is; however, the box will say "suppositories." You will also want to pick up some lubrication jelly. Have Marcus lie on his side with his knees bent up. Once you are ready, wash your hands and open the suppository packet. The suppository will look like a bullet. Squirt some of the lubrication jelly on the pointed end of the bullet. Then, use your finger to gently insert the suppository, pointed end first, about 1 in (2.5 cm) into Marcus' rectum, which is about to your top knuckle line. Then, wipe off any extra lubricant with a towel or tissue and wash your hands. Have Marcus continue lying down for about five to ten minutes to allow the medication time to absorb.

Parent: Is that it? That doesn't sound too bad.

Nurse: That's it. Can you repeat the instructions back to me?

Parent: I am going to go to the store to get the suppositories and some lube. I'll have Marcus lie down on his side and tell him to pull his knees up. Then I will wash my hands, open the packet, and squirt the lube on the tip of the suppository. Then, push it about 1 in (2.5 cm) into his bottom, which is about where the tip of my finger bends. Then, wipe off his bottom, wash my hands, and have him lie there for five to ten minutes.

Nurse: Perfect, it sounds like you know what to do. If Marcus's fever doesn't go down or gets any higher, you should take Marcus to an urgent care or emergency room for further evaluation and treatment.

Parent: I sure will.

Nurse: Do you have any questions for me?

Parent: No, I appreciate you explaining what I need to do. I just hope it helps my baby.

Nurse: As do I. If you have any questions later on or have any trouble with the suppository, please feel free to call me back and I will walk you through what to do.

Parent: I sure will. Thank you, again.

Scenario follow-up: Thankfully, the child's fever was reduced to 99.4°F (37.4°C) after administering the suppository. The child was seen at the clinic the next day for further assessment and diagnostics to determine the cause of the fever.

Forms of Rectal Medications

Rectal medications are prepared as suppositories or liquids. Suppositories are solid medications that melt and absorb into the bloodstream after being placed in the rectum. Usually, suppositories are narrowed and rounded at one end to allow easy entrance into the rectum (Figure 14.24). Examples of medications that may be administered as rectal suppositories for fever and pain (acetaminophen [Tylenol]), constipation (glycerin rectal suppositories [Fleet Glycerin]), nausea and vomiting (promethazine rectal [Phenergan]), or certain bowel conditions (mesalamine rectal [Canasa]).

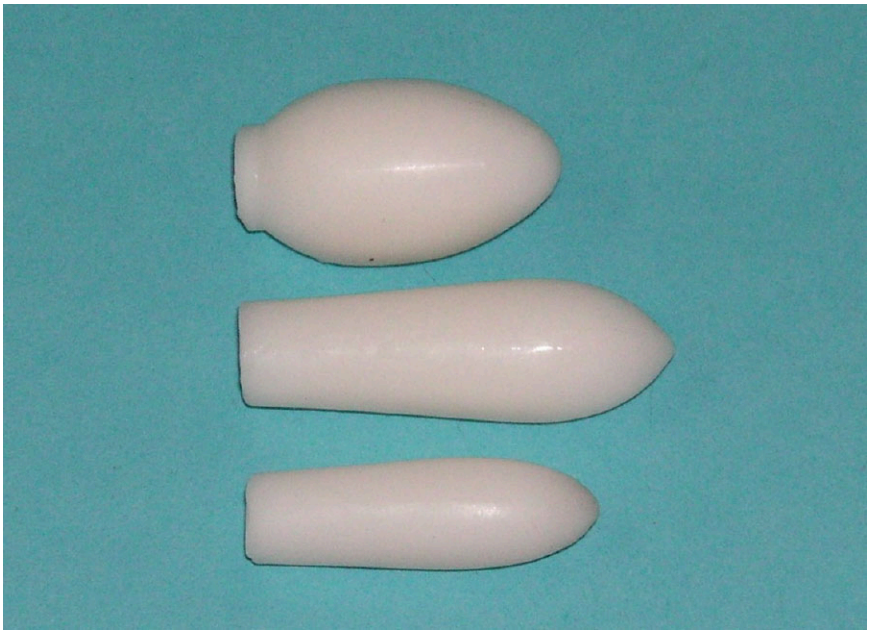

FIGURE 14.24 Suppositories are rounded on one end to allow for easy entry into the rectum. (credit: "Suppositories three different sizes" by Alcibiades, Public Domain)

Typically, rectal medications prepared in liquid form have a faster rate of absorption than suppositories because they do not require the body to melt the medication before being absorbed. The most common liquid medications administered via the rectal route are **enema**s. Enemas may contain a liquid solution that is placed in a disposable plastic squeeze bottle and then instilled into the rectum. Other forms of enemas (e.g., soap suds enemas) contain the solution in a bag that is connected to tubing that is inserted in the rectum and instilled by gravity. Enemas may be used to treat constipation, seizures, and certain bowel conditions; they are also used for bowel preparation before gastrointestinal diagnostic or surgical procedures.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering a Large-Volume Cleansing Enema

See the competency checklist for Administering a Large-Volume Cleansing Enema. You can find the checklists on the Student resources tab of your book page on openstax.org.

Procedural Steps for Rectal Medication Administration

Before administering rectal medications, the nurse assesses potential contraindications (e.g., recent rectal or prostate surgery). The nurse should ask the patient to defecate before rectal medication administration. The nurse should perform hand hygiene, don gloves, perform the same rights of medication administration as is completed with other types of medications, and provide the patient privacy. Position the patient in the **Sims position** (i.e., on their left side with the upper leg flexed over the lower leg toward the waist) (Figure 14.25). Place a drape under the patient's buttocks to protect the linens from potential contamination. Assess the patient for contraindications, such as diarrhea or active rectal bleeding. If gloves become soiled, remove the soiled gloves and don new nonsterile gloves.

FIGURE 14.25 The Sims position is the appropriate position for the patient for inserting a suppository. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

If administering a suppository, remove the medication from the wrapper and lubricate the rounded tip of the suppository and index finger of the dominant hand with a water-based lubricant. If administering an enema, lubricate only the tip of the enema. With the nondominant hand, separate the buttocks and insert the rounded end of the suppository with the index finger, inserting it into the rectum toward the umbilicus (Figure 14.26). While inserting the suppository, instruct the patient to take slow deep breaths in and out to help relax the anal sphincter. Insert the suppository approximately 2 in (5 cm) beyond the anal sphincter to promote absorption of the medication. If an enema is being administered, follow the same procedure; however, expel the air from the enema container before inserting it into the rectum. Roll the plastic bottle from bottom to top until all the contents have been inserted into the rectum.

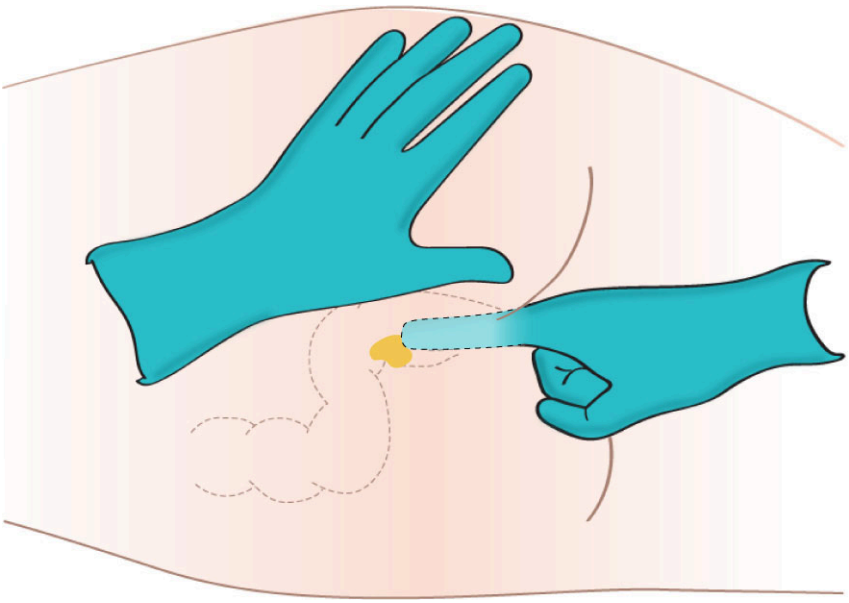

FIGURE 14.26 The nurse inserts the suppository into the rectum toward the umbilicus. (attribution: "Administering Medication Rectally" by British Columbia Institute of Technology, CC BY 4.0)

After inserting a suppository, the nurse removes their finger and wipes the excess lubricant from the anal area. The nurse instructs the patient to remain on their side for five to ten minutes to prevent accidental expulsion of the medication. Suppositories may also be administered via the colostomy stoma, depending on the patient's condition. The nurse performs hand hygiene and assesses the patient for any unexpected situations (e.g., the suppository coming out). The nurse then documents administration of the medication as well as the patient's tolerance of the medication and procedure.

Summary

14.1 Administering Eye Medications

Ophthalmic medications are commonly used to treat allergies, dry eyes, viral or bacterial infections, and glaucoma. Medications administered via the ophthalmic route include eye drops, ointments, and medication disks. Eye drops are prepared in liquid solutions, ointments are greasy semisolids that melt after being placed in the eye, and disks are flexible medication disks that release medication over one week's time and then must be removed. Medications administered via the eye should never be used if expired.

Irrigations are a treatment for flushing secretions, chemicals, and foreign bodies from the eye. Typically, a local anesthetic eye drop will be placed into the affected eye and then normal saline is injected with a syringe onto the front surface of the eye, inside the lower eyelid, and under the upper eyelid. When irrigating an eye, the patient should be lying down with the affected eye down. The irrigant should be brought to room temperature and be held no more than 2 in (5 cm) away from the eye. To maintain sterility, the tip of the syringe should be kept sterile at all times and should never touch the surface of the eye or eyelid.

When confirming the rights of medication administration, it is important to note the number of drops to be administered and in which eye to place the drop. Before administering eye medications, assess the patient's eyes and gently cleanse any dirt, debris, or crust with a gauze or washcloth dampened with warm water or normal saline. Wipe the eye from the inner canthus of the eye to the outer canthus and use a new gauze or corner of the washcloth with each stroke. Shake the medication, if indicated. Instruct the patient to tilt their head back, or lie down, and look upward. Using the thumb and/or index finger, gently pinch the eyelid and pull downward to form a pocket. Gently squeeze the medication into the conjunctival sac and instruct the patient to keep their eye closed for one minute. Press one finger against the inner canthus of the eye to prevent the medication from going into the tear duct.

14.2 Administering Ear Medications

Ear (i.e., otic, auricle) medications may be indicated for treating infections or inflammation, providing local anesthesia, softening cerumen for removal, and facilitating removal of objects from the ear canal. Ear medications may be prepared as ear drops or a medicated ear wicks. Ear drops are placed in the ear canal, whereas medications administered via medicated ear wicks are placed on the end of the wick that has been placed at the entrance of the ear canal. Ear medications may be used for people with surgically placed ear tubes; however, ear medications should not be used for patients with ruptured eardrums, unless otherwise indicated by the provider. The risk of experiencing an infection is increased if the eardrum is ruptured; therefore, aseptic technique should be followed (e.g., ensuring the tip of the ear medication bottle and inside of the bottle cap remain sterile).

Ear irrigation may be warranted to remove foreign objects or wax buildup from the ear canal. Side effects of ear irrigations include dizziness, pain, nausea, and ringing in the ears. Ear irrigations should not be performed on patients with damaged eardrums, tubes in their ears, or an active infection in their ear canal, unless otherwise indicated by the provider. Risks of ear irrigation include ear infections, a perforated eardrum, vertigo, and hearing loss.

The provider should assess the ear canal with an otoscope before irrigating the ear. Position the patient upright and hold an irrigation basin under the affected ear. Gently pull the ear upward and back for an adult patient or downward and back for a pediatric patient. Room temperature normal saline or saline and hydrogen peroxide is then injected slowly into the ear canal, away from the tympanic membrane, using a needless syringe or catheter. Solutions that are too hot or too cold may cause the patient discomfort, dizziness, or vertigo. Place a cotton ball in the ear and position the patient on the side toward the affected ear.

Medications administered via the ear must be labeled for otic use. After confirming the rights of medication administration, performing hand hygiene, and donning gloves, instruct the patient to lie on the side opposite the affected ear. Then clean the external ear of any debris. Ensure the medication is at room temperature to prevent discomfort, dizziness, vertigo, and nausea. Straighten the patient's ear canal by pulling the auricle up and back for an adult patient and down and back for a pediatric patient. Gently squeeze the medication toward the side of the auditory canal and away from the tympanic membrane, ensuring the tip of the medication bottle remains sterile. Massage the tragus and instruct the patient to continue lying on their side for five minutes. Remove and dispose of the gloves and perform hand hygiene when finished.

14.3 Administering Nasal Medications

Nasal medications are absorbed into the systemic system faster than oral medications. Nasally administered medication may be used to treat a variety of conditions, such as allergies, sinus infections, and nasal congestion. Nasal medications come prepared as powders or liquids inside a spray device, or as a nasal wash. Powders and sprays are delivered as one dose per spray in the nostril. Nasal washes are used to irrigate mucus, irritants, allergens, bacteria, and viruses from the nose. While leaning over the sink, a saline solution with distilled or sterilized water is squirted into one nostril, passes through the sinus cavity, and exits the other nostril. Devices used for nasal administration should be kept clean and used on a single patient.

Nasal medications may also be inhaled into the respiratory system. Categories of nasal inhalation medications include antihistamines, steroids, decongestants, mast cell inhibitors, anticholinergics, and opioid antagonists. These medications may be used to treat allergy symptoms, treat opioid overdose, and reverse respiratory depression.

Medications administered via the nasal route are administered using clean technique. After confirming the rights of medication administration and performing hand hygiene, instruct the patient to blow their nose. Position the patient so they are either sitting with the head tilted backward or lying supine looking up. Insert the tip of the spray bottle in one nostril, occlude the other nostril, and press down on the spray applicator while the patient inhales. The patient should be instructed to hold their breath for a few seconds and to avoid blowing their nose for five to ten minutes after administration.

14.4 Administering Inhaled Medications

Inhaled medications can be administered to treat respiratory illness, reduce inflammation, and open the lungs. Inhaled medications are absorbed by the lungs and have a quicker onset than oral medications. Medications administered by inhalation may be administered by nebulizers or hand atomizers.

Nebulizers are electric or battery-powered machines that use oxygen or compressed air to mist medication into the lungs via a face mask or mouthpiece. Nebulizers are beneficial for administering multiple medications at once and do not require coordinated breaths; however, they are not easy to transport, require a power source, and take ten to fifteen minutes to administer the medications. Bronchodilators and antibiotics may be administered via nebulizer; however, steroids cannot.

Hand atomizers are handheld devices that do not require a power source for administration. There are three main types of hand atomizers: metered-dose inhalers, dry powdered inhalers, and soft-mist inhalers. Inhalers should be cleaned frequently to prevent bacterial growth.

Metered-dose inhalers (MDI) contain a canister attached to a mouthpiece that is used to create an aerosolized mist of medication. Medication waste is common with MDIs because mist particles stick to the tongue or aerosolize in the air.

Dry powder inhalers (DPI) use an inward breath to move the powdered medication into the lungs. DPIs require a harder breath; however, they are easy to use and do not require coordinated breathing efforts.

Soft-mist inhalers are handheld devices that turn liquid medications into a mist cloud that can then be inhaled without a propellant. This type of inhaler does not require coordinated breathing efforts or a spacer.

There are four categories of inhaled medications: bronchodilators, steroids, antibiotics, and dornase alfa. Bronchodilators relax the muscles in the lungs and widen the airways. Bronchodilators may be short-acting or long-acting and are used to treat long-term conditions, such as asthma and COPD. Steroids reduce inflammation and prevent flare-ups of respiratory conditions. Antibiotics may be warranted to deliver antibiotics directly into the respiratory tract for patients with chronic respiratory diseases, such as cystic fibrosis (CF), non-CF bronchiectasis, and ventilator-associated pneumonia. Dornase alfa is used to thin the mucus in the airways for patients with CF. When administering more than one category of inhaled medications, administer the medications in the following order: bronchodilators, dornase alfa, antibiotics, and steroids.

14.5 Administering Other Medications

Hormone therapies, antifungal treatments, and contraception may be ordered via the vaginal route. Vaginal medications come prepared in a variety of forms, such as creams, foams, suppositories, and tablets. The medication

is either squeezed into an applicator (i.e., creams, foams) or placed at the end of the applicator (i.e., suppositories, tablets) and inserted into the vagina. Prior to administering medications via the vaginal route, instruct the patient to void. Position the patient on their back with their knees flexed, and perform perineal care. Prepare the medication and lubricate the applicator with a water-based lubricant. Insert the applicator into the full length of the vagina and push the plunger to release the medication. Instruct the patient to remain lying down for at least five to ten minutes to prevent the medication from leaking out.

Medications ordered via the rectal route may be indicated for constipation, analgesia, nausea and vomiting, or certain bowel conditions. Rectal medications are contraindicated with rectal bleeding; diarrhea; rectal prolapse; low platelet count; or after rectal, bowel, or prostate surgery because of the risk of perforation. Rectal medications are prepared as suppositories and liquid enemas. Instruct the patient to defecate, if possible, before administering rectal medications. Position the patient on their left side with their upper leg flexed over their lower leg toward their waist. Lubricate the suppository or enema with a water-based lubricant, instruct the patient to take slow deep breaths in and out to help relax the anal sphincter, and insert the medication into the rectum approximately 2 in (5 cm) beyond the anal sphincter. When administering an enema, expel the air before insertion and roll the bottle until all contents have been instilled.

Key Terms

anticholinergic spray a medication that blocks the activity of acetylcholine and is used to treat symptoms of a runny nose

auricle the outer projection, earlobe-shaped portion of the ear

bronchodilator a medication that relaxes the muscles in the lungs and widens the airway

cerumen earwax

corticosteroid a medicine that reduces inflammation and prevents flare-ups of respiratory conditions

cream a semisolid emulsion containing a suspended or dissolved medication

decongestant a medication that provides short-term relief of nasal congestion

dornase alfa (Pulmozyme) an inhaled medication consisting of a synthetic protein that breaks down excess DNA in the pulmonary secretions of people with cystic fibrosis

dry powder inhaler (DPI) a device that delivers dry powder medications that are inhaled through a the mouth and into the lungs

ear drops liquid solutions injected into the ear canal

ear irrigation the washing out of the ear with a continuous flow of liquid or medication

enema a liquid solution placed in a disposable plastic squeeze bottle and then instilled into the rectum, or the solution is placed in a bag connected to tubing that is inserted in the rectum and instilled by gravity

eye drops liquid solutions intended for use in the eye

eye irrigation the washing out of the eye with a continuous flow of liquid or medication

eye medication disk a small, flexible disk placed horizontally in the conjunctival sac that can release medication in the eye for up to one week

eye ointment a greasy semisolid that uses body warmth to melt into tiny drops that rest between the eyeball and eyelid

foam a liquid medication dispersed in gas that results in a light, frothy substance

hand atomizer (also, inhaler) a pocket-sized device that delivers medications into the lungs without the use of electricity

inner canthus the corner of the eye nearest the nose where the upper and lower eyelids meet

mast cell inhibitor a medication that relieves allergy symptoms by stabilizing mast cells, which inhibits histamine release

medicated ear wick a small cellulose wick placed in the ear canal, with the outer portion of the wick visible at the entrance of the ear canal; medication is then applied to the end of the wick, dispersing the medication throughout the ear

metered-dose inhaler (MDI) a device that creates an aerosolized mist of medication that is inhaled through the mouth and into the lungs

nasal relating to the nose or nostrils

nasal wash (i.e., nasal irrigation) a method that helps clean mucus, allergens, irritants, bacteria, and viruses from the nose

nebulizer a small electric or battery-powered machine that delivers a fine mist of liquid medications
ophthalmic relating to the eye
opioid antagonist a medication used to treat opioid overdose and reverse respiratory depression associated with opioid use
otic relating to or located near the ear
otoscope a tool that shines light into the ear to visualize the ear canal
outer canthus the corner of the eye nearest the ear where the upper and lower eyelids meet
rectal relating to or affecting the rectum
Sims position a posture where the patient is positioned on their left side with the upper leg flexed over the lower leg toward the waist
soft-mist inhaler a handheld device that turns liquid medications into a mist cloud that can then be inhaled without a propellant
spacer a clear tube that fits between the inhaler and the mouthpiece, allowing the medication to move into the spacer for the patient to inhale more slowly and with control
suppository a solid medication that melts inside the body and is absorbed into the bloodstream
tragus the small piece of thick, skin-covered cartilage in front of the meatus of the external ear immediately in front of the ear canal
vaginal relating to or affecting the vagina

Assessments

Review Questions

1. The nurse is preparing to perform an ocular irrigation for a patient who presents with a foreign object in the eye. What action should the nurse plan to take?
    a. Assess the patient's visual acuity before performing irrigation.
    b. Have the patient turn their head toward the unaffected eye.
    c. Hold the irrigation syringe within 2 in (5 cm) of the eye.
    d. Perform the irrigation with sterile water.

2. A new graduate is speaking with the preceptor about eye medication disks. What indicates an accurate understanding regarding this form of eye medication?
    a. Eye medication disks should be placed on the cornea.
    b. Eye medication disks should be inserted horizontally.
    c. Eye medication disks are contraindicated if the patient has contact lenses.
    d. Eye medication disks may be repositioned by rubbing the eye.

3. The nurse is preparing to administer eye drops. What is the appropriate procedure for administering eye drops?
    a. Administer ointments first, followed by drops.
    b. Place the eye drop in the inner canthus of the eye.
    c. Press one finger against the inner canthus of the eye after administering the eye drop.
    d. Wipe dirt and debris away from the eye from the outer canthus to the inner canthus.

4. The provider orders an eye ointment and an eye drop to be administered at the same time. What is the procedure for administering eye drops and eye ointments scheduled for the same administration time?
    a. Administer the eye ointment first, followed by the eye drop.
    b. Administer the eye drop first, followed by the eye ointment.
    c. Administer the eye ointment, wait five minutes, then administer the eye drop.
    d. Administer the eye drop, wait ten minutes, then administer the eye ointment.

5. The nurse is preparing to irrigate a patient's eye. What action reduces the risk of contamination?
    a. Ask the patient to move their eye in all directions throughout the irrigation.
    b. Ensure the irrigant is at room temperature.

c. Inject the irrigant in the eye without touching the eye or eyelid.
d. Instruct the patient to keep their eye closed throughout the irrigation.

6. The nurse prepares an adult patient for an otic irrigation. What action should the nurse take when performing the otic irrigation?
a. Instill the irrigation slowly, toward the eardrum.
b. After the irrigation, position the patient with the affected side up.
c. Pull the ear downward and back before inserting the syringe.
d. Warm the irrigant solution to room temperature.

7. The nurse is administering ear medications with the nursing student. What action by the nursing student would warrant further education?
a. aiming the bottle toward the tympanic membrane
b. instructing the patient to lie on their side for five minutes
c. massaging the tragus after administering the ear medication
d. warm the medication to room temperature

8. The nurse is educating a patient on medicated ear wicks. What information should the nurse include in the education?
a. As the wick contracts, the medication is released into the ear.
b. Medicated ear wicks are changed daily.
c. Medications are administered within the ear and absorbed by the wick.
d. The outer portion of the wick should be visible at the entrance of the ear canal.

9. The provider orders ear drops to be placed in both ears. What is the procedure for administering ear drops in both ears?
a. Administer the ear drops to both ears at the same time.
b. Administer the ear drops in one ear, followed by the other ear.
c. Administer the ear drops in one ear, wait five minutes; then, administer the ear drops in the other ear.
d. Request the pharmacy to schedule two different administration times.

10. While performing an ear irrigation, the patient complains of dizziness. What action should the nurse take?
a. Assure the patient that dizziness is common with ear irrigations.
b. Instruct the patient to lie down and continue with the irrigation.
c. Stop the irrigation and examine the ear canal.
d. Warm the irrigation solution.

11. The nurse is caring for a patient with glaucoma. What nasal medication is contraindicated for patients with glaucoma?
a. antihistamines
b. decongestants
c. mast cell inhibitors
d. steroids

12. The nurse is educating the patient on how to perform a nasal wash. What instructions should the nurse include in the education?
a. Clean the nasal wash equipment at least once per week.
b. Do not block the opposite nostril.
c. Mix the saline solution with tap water.
d. Squirt the solution into the nostril and then blow your nose.

13. The nurse is preparing to administer a nasal medication. How should the patient be positioned?
a. lying down with the head tilted toward the affected side

b. lying down with the head tilted toward the unaffected side
c. sitting with the head tilted backward
d. sitting with the head tilted forward

14. The nurse is administering nasal medications with the nursing student. What action by the nursing student demonstrates the proper procedure for administering nasal medications?
a. Activate the nasal spray as the patient exhales.
b. Instruct the patient to blow their nose after administering the medication.
c. Spray the medication toward the septum.
d. Wipe the outside of the bottle after administering the medication.

15. The nurse is precepting a nursing student. Before administering medications, the nurse asks the student to discuss each medication. What demonstrates a correct understanding of nasal inhalation medications?
a. Nasal mast cell inhibitors block histamine release.
b. Nasal antihistamines typically cause more drowsiness than oral medications.
c. Nasal decongestants cause the blood vessels in the nose to expand.
d. Nasal anticholinergics are used for long-term relief of allergy symptoms.

16. The nurse is preparing to administer a medication via a nebulizer. How should the nurse instruct the patient to breathe?
a. Breathe normally through your nose.
b. Breathe out and then press the nebulizer down while breathing in.
c. Hold your breath for ten seconds and exhale, then repeat.
d. Take slow, deep breaths, pausing for two to three seconds before each exhale.

17. The provider orders more than one category of inhaled medication for the patient. In what order should the nurse administer the inhaled medications?
a. antibiotic, dornase alfa, steroid, bronchodilator
b. bronchodilator, dornase alfa, antibiotic, steroid
c. dornase alfa, bronchodilator, steroid, antibiotic
d. steroid, bronchodilator, antibiotics, dornase alfa

18. Spacers may be used to reduce the waste of inhaled medications. What form of inhaled medication can be administered using a spacer?
a. dry powder inhaler
b. metered-dose inhaler
c. nebulizer
d. soft mist inhaler

19. The nurse is precepting a nursing student. What comment by the nursing student would warrant further education?
a. Administering dornase alfa and bronchodilators together at the same time will enhance the effects of the bronchodilator.
b. Beta-2 antagonists should be used with caution for patients with cardiac conditions.
c. Inhaled antibiotics may cause breathing problems, dizziness, or kidney problems.
d. Patients taking inhaled steroids should be educated on how to prevent oral thrush.

20. The nurse is preparing to administer inhaled medications. What is the correct procedure for administering inhaled medications?
a. Activate the metered-dose inhaler prior to the patient inhaling.
b. Attach the nebulizer to oxygen at a flow rate of 10 to15 L/min.
c. Hold the metered-dose inhaler 1 to 2 in (2.5 to 5cm) from the patient's mouth.
d. Educate the patient on the importance of coordinating their breaths when using spacers.

21. The nurse is educating the patient on vaginal medications. What should the nurse include in the education?
   a. Vaginal medications cannot be used during menstrual cycles.
   b. Vaginal medications have a slower onset than oral medications.
   c. Vaginal medications may cause vaginal dryness and itching.
   d. Vaginal medications should be stored in a cool, dry place.

22. The nurse is preparing to administer a vaginal medication. What should the nurse do?
   a. Instruct the patient to continue lying down for at least three minutes after administration.
   b. Lubricate the applicator with an oil-based lubricant before inserting it into the vagina.
   c. Place the applicator into the full length of the vagina.
   d. Position the patient on their left side with the upper leg flexed over the lower leg toward the waist.

23. The nurse is caring for a patient who underwent a bowel resection two days ago. An order is received to administer a suppository per rectum. What is the first action the nurse should take?
   a. Ask the patient to defecate.
   b. Call the provider.
   c. Perform hand hygiene.
   d. Position the patient.

24. The nurse is preparing to administer a rectal medication. What action should the nurse take?
   a. Expel the air from the enema before inserting it into the rectum.
   b. Insert the medication about 3 in (7 cm) beyond the anal sphincter.
   c. Lubricate the medication with a water-insoluble lubricant.
   d. Position the patient on their back with knees flexed.

25. The nurse is assessing contraindications for rectal medication administration. What medical condition can a patient have and still receive suppositories?
   a. colostomy
   b. diarrhea
   c. low platelet count
   d. rectal bleeding

Check Your Understanding Questions

1. Name three conditions that may be treated with eye medications.

2. Name three conditions that may be treated with ear medications.

3. Name three conditions that may be treated with nasal medications.

4. What action must be taken before a nasal spray is used for the first time?

5. Describe how the three different types of hand atomizers are used.

6. How would you administer a nebulizer to a patient receiving oxygen therapy?

7. Name four forms of vaginal medications.

8. What patient conditions would contraindicate rectal medication administration?

Reflection Questions

1. While administering ophthalmic medications, the nurse drops the lid to the eye drop medication bottle on the floor. What should the nurse do?

What Should the Nurse Do?

A patient is seen in the clinic for conjunctivitis (pink eye). The provider orders erythromycin eye ointment to be administered to the left eye, once daily. The patient does not have a prior history of conjunctivitis and reports having

never used an eye ointment in the past. The nurse is educating the patient on how to administer the medication.

1. When is the best time of day to administer the medication?
2. How much of the ointment should be administered?
3. How should the medication be administered?
4. What additional instructions should be given to the patient?
5. While administering otic medications, the nurse drops the lid to the ear drop medication bottle on the floor. What should the nurse do?

A patient is seen in the clinic with a significant amount of cerumen built up in the ear canal. The provider orders the patient's ear to be irrigated. The nurse is preparing the patient for the procedure.

6. What are the contraindications for performing an ear irrigation?
7. What side effects should the nurse be looking for?
8. What are the risks of performing an ear irrigation?

The nurse is caring for a patient on postoperative day one. The provider places an order for the patient to receive a bisacodyl (Dulcolax) suppository per rectum. The nurse is preparing to administer the suppository when the physical therapist enters the room to assist with mobilizing the patient.

9. What should the nurse consider before administering the medication?
10. How should the nurse coordinate administration of the medication and physical therapy?

Competency-Based Assessments

1. Demonstrate the appropriate procedure for administering eye drops.
2. Create a video demonstrating the appropriate procedure for administering ear drops.
3. Review the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 15

General Survey, Anthropometric Measurement, and Vital Signs

FIGURE 15.1 The first encounter between the nurse and the patient is the beginning of the nurse's assessment. During this encounter, the nurse will observe, listen, ask appropriate questions, and start the assessment process. (credit: FYNI Media/Flickr, CC BY 2.0)

CHAPTER OUTLINE

15.1 Performing a General Survey
15.2 Common Types of Anthropometric Measurements
15.3 Vital Signs
15.4 Temperature
15.5 Heart Rate
15.6 Respiration
15.7 Blood Pressure

INTRODUCTION So much information is gathered during the nurse's first encounter with a patient. To support the gathering of necessary information, it is critical for the nurse to be observant, while also being friendly and welcoming. A friendly nurse encourages conversation and helps the patient to feel at ease. Through the nurse's actions, words, and body language, a sense of trust and safety can be developed between the nurse and patient. Friendliness can develop the needed trust, while professionalism can help the patient feel safe in an unfamiliar environment. Building a relationship with patients helps establish trust. When patients feel comfortable with their nurse, they are more likely to share important information about their health, concerns, and preferences. Patients are more likely to ask questions, seek clarification, and share their thoughts and concerns when they feel a connection with their nurse.

Developing a relationship with patients allows nurses to better understand their individual needs, preferences, and

values, which in turn enables the delivery of patient-centered care, tailored to the specific needs and goals of each patient. Developing relationships also provides emotional support, compliance, and engagement in care. The nurse should foster a sense of teamwork with the patient, striving together for the goal of the patient's well-being. During this time, the nurse uses skills to assess the overall status of the patient and obtain vital data and measurements that guide the personalized care the patient deserves.

15.1 Performing a General Survey

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Differentiate between normal and abnormal findings in the general survey
- Describe nursing observational and interviewing skills needed for performing a general survey assessment
- Identify instruments needed for proper measurement

Nurses know that patients are more than just data. Data, such as vital signs and measurements, do provide a wealth of information, but the key to determining an individual's health is combining that critical data with the nurse's observation of the patient. The nurse's observations also provide a source of important information. For an individual to be at peak health, a state of homeostasis must be achieved. Homeostasis is regulated without compensation from external sources or systems. Often body systems work in tandem to create a whole body homeostasis. Examples include blood sugar regulation after a meal or body temperature regulation.

Generalized Survey of Patient's Health Status

The nurse walks into the patient's room for the first time and can already begin assessing before even seeing the patient. What does the nurse feel, hear, and smell? Is the room temperature appropriate? Is the television volume up abnormally high? Are there any unusual smells? Then the nurse meets the patient and gains more information. What does the patient look like? Are they awake? Are they struggling to breathe? What can the nurse gather from the patient's verbal and nonverbal communication? During the first meeting of the nurse and patient, assessment has already begun. First impressions matter, both in social settings and health care. Just as confidence and a smile leave a good first impression in social settings, a patient's appearance, behavior, age, culture, size, and cognition should be noted and may be used to provide further information to determine the patient's health needs.

Patient Appearance

The first thing a nurse notices in patients is appearance. Objective assessment questions can provide valuable information for the nurse at the beginning of the assessment. What is the patient's age? What is their height and weight? Are there any noteworthy nonverbal cues, such as indications of pain, anger, or fear? What is their mobility status? Do they use assistive devices? The answers to these questions can guide the nurse's assessment.

Other data gained during the first encounter can also guide the nurse's assessment. Specifically, the nurse should note if the patient is well groomed, dressed appropriately for the weather, appears comfortable, is a healthy size, and the color and tone of the patient's skin. The patient's color and tone should be examined to note pallor, flushing, dryness, the presence of moisture, and areas of discoloration. These are just some of the observations that could help a nurse pinpoint an abnormality. A patient who is not well-groomed or well-dressed could be struggling to be able to perform activities of daily living independently. An inability to perform these activities may be due to physical or mental limitations. A patient who appears uncomfortable could be struggling with pain or difficulty breathing. An abnormal gait may also suggest an underlying physical limitation. A patient's size and weight could be estimated not only to determine the type of scale needed but also to provide general information about the patient's activity and muscle mass. A weight measurement gives an objective assessment of the patient's size; however, it does not classify the overall health of an individual. Since a weight measurement alone does not give a complete assessment of health, weight measures are typically considered in context with height, other physical attributes such as muscle mass, and body processes such as pregnancy. Abnormalities noted during an assessment of the patient's skin are also an indication that a more detailed assessment is needed. Abnormal skin coloring and tone may require further investigation. Paleness of the skin and mucous membranes, or **pallor**, could indicate, among other things, a lack of oxygen or blood flow. Yellowing of the skin and sclera, known as **jaundice,** often indicates a liver abnormality. A bluish or dusky tint to the skin, called **cyanosis**, indicates a critical lack of oxygen, particularly if seen in the face and

chest. A flushed face can indicate high blood pressure, exertion, or exposure to cold weather. Key areas to look for skin coloring abnormalities are the lips and mucous membranes and sclera of the eyes (Figure 15.2).

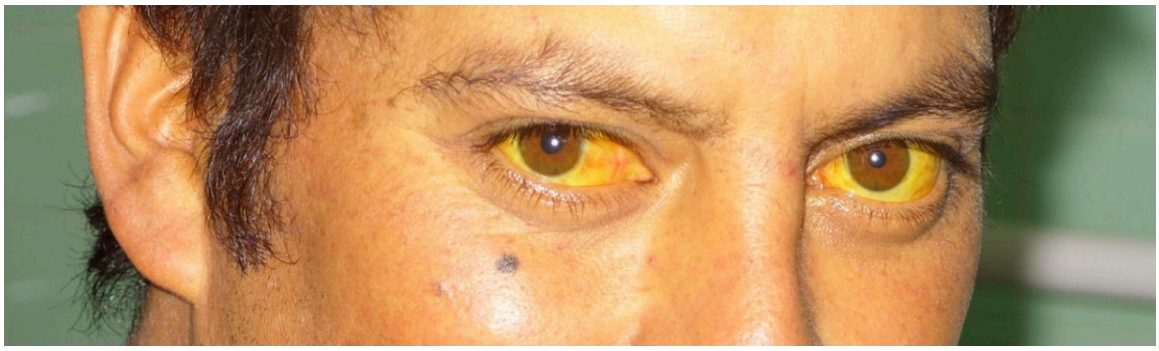

FIGURE 15.2 A patient can present with jaundice with a normal skin tone and yellowing of the eyes. (credit: Sheila J. Toro/Wikimedia Commons, CC BY 4.0)

Patient Behavior

Another vital observation is the behavior of the patient. Calm and relaxed may indicate no acute distress, but many other behaviors may not be considered "inappropriate" depending on the situation. As discussed previously, a patient's behavior can indicate the health of an individual and alert the nurse to the need for further investigation. Unexpected or atypical behaviors can indicate anything from psychiatric conditions, hypoxic states, infections, or neurological complications. Anxiety can be noted by pacing, fidgeting, or simply an inability to sit still. While restlessness may be a sign of anxiety, it is also an early sign of hypoxia. Other signs of hypoxia and respiratory distress include posturing such as leaning forward with hands on a table, lethargy, inability to ambulate, accessory muscle use, cyanosis, and pallor. It is the nurse's responsibility to investigate behavior and determine its cause. A depressed individual may avoid eye contact and have a flat affect. There are times when behaviors associated with anxiety, fear, and depression would be expected. Examples of this would include a father in the labor and delivery unit, a spouse who has just lost a partner, or a patient receiving life-altering news.

Age, Gender, and Cultural Variations

Determining the patient's age, gender, and culture are helpful as a nurse plans care for an individual. An estimate of the patient's age is gathered through visually assessing the patient's height, weight, head circumference, and skin tone and presence of wrinkles and comparing the estimate to the actual age. A significant discrepancy between the two may warrant further investigation. A 7-year-old who appears to have the physical features of a toddler would be worrisome as would a 40-year-old who has features making them appear much older in age. Gender and culture observations require further analysis. Many diseases and conditions are linked to biological sex and ethnical backgrounds. For instance, those of Jewish descent are linked to a higher predisposition to Tay-Sachs disease, and those of African descent are predisposed to sickle cell anemia (MedlinePlus, 2021). A patient's biological sex can identify ways the disease itself affects the body. For instance, although both males and females are equally diagnosed with diabetes, the disease causes a greater risk of coronary artery disease in female patients (Yoshida et al., 2023). Identification of the patient's biological sex and ethnicity will help the nurse determine if risk factors are present. These topics can be sensitive, and best practice standards indicate for the nurse to ask the patient directly, instead of making assumptions about the biological sex of the patient. It is also vital to be aware and practice in a culturally sensitive manner, but without making assumptions about an individual's ethnicity and culture. Again, best practice would be to ask patients directly about their specific cultural preferences.

PATIENT CONVERSATIONS

How Do You Ask about Cultural Preferences without Assuming a Patient's Culture?

Scenario: A nurse begins the admission history and assessment on a female who appears to be of Asian descent, one week after she delivered a baby. She is being hospitalized for sepsis.

Nurse: Do you have any past medical history?

Patient: Just a touch of asthma.

Nurse: Any past surgeries?

Patient: Just the C-section a week ago.

Nurse: Can you tell me about any family medical history?

Patient: My dad had colon cancer, and my mom has high cholesterol.

Nurse: Are you currently taking any medications?

Patient: I've been taking Tylenol and ibuprofen since I delivered. I haven't taken those Percocet though since I left the hospital.

Nurse: Okay, that looks like it may be all. I do want to make sure we provide you with the best possible care while you are here. Are there any cultural preferences that you adhere to during this postpartum period?

Patient: Thank you for asking. Yes, we do try to abide by a confinement period for forty-five days and avoid drafts and cold. If possible, I would like the air conditioner turned down and some extra blankets.

Nurse: Absolutely. No problem at all. I will run and grab those blankets now and lower the thermostat.

Scenario follow-up: From this conversation, the nurse was able to address cultural needs while remaining culturally sensitive. The nurse did not make any assumptions regarding the patient's culture but asked the patient directly and respectfully regarding her cultural preferences.

Growth and Developmental Status

A patient's growth and development typically follow a relatively standard progression from infancy through adulthood. Periods of rapid physical growth are seen in the young while plateauing should be observed in adulthood, and then potential loss of height in late adulthood. Physical and cognitive development also have periods of rapid gains and slower gains, but there should never be a loss of developmental milestones in healthy individuals, such as walking, talking, and cognition. Growth and development assessments are essential to determine if a patient is progressing through the stages of life as expected and are measured throughout the life span. A patient's growth is obtained through anthropometric measurements and compared to normal values for the individual's age.

LINK TO LEARNING

The Centers for Disease Control and Prevention publishes growth charts for infants and children (https://openstax.org/r/77growthcharts) to track children's growth.

Development is another objective finding that compares the individual's physical and cognitive abilities with expected findings for their age. Alterations in growth could indicate hormone deficiencies or conditions that affect the function of the pituitary gland. Alterations in development could indicate cognitive issues or neurological dysfunctions. A child who begins to lose the ability to walk may be evaluated for muscular dystrophy, an incurable and fatal disease. A child who loses the ability to talk or never talks would be evaluated for autism and other genetic conditions. Growth is plotted particularly through weight and height but also includes head circumference for children 3 years old and younger. Development is assessed by both observation and interviewing. Development involves the mastery of developmental tasks in gross motor skills, fine motor skills, speech, and social skills. If there is a concern that development is delayed, typically in children, specific tests may be employed, such as the Denver II Developmental Screening Test.

LINK TO LEARNING

The Denver Developmental Screening Test (https://openstax.org/r/77denverdevscreen) helps practitioners assess the developmental milestones of children.

Cognitive Status

Assessing the cognitive status includes the patient's level of consciousness, facial expression, speech, and mental acuities. If abnormalities exist, a more in-depth mental examination is needed. The first aspect of cognitive assessment is determination of the patient's level of consciousness, or their level of awareness and arousal. Assessing and addressing a patient's pain is also imperative because pain can interfere with the patient's ability to engage with the nurse's cognitive assessment. Patients who are alert and with intact cognition should be able to provide the following information:

- (person) name
- (place) location
- (date) day of the week, month, or year
- (time) general idea of the time of day

If a patient can answer these questions correctly, they are deemed alert and oriented times four—meaning the patient is alert to person, place, date, and time—and this is charted as A&O ×4. If their answers are incorrect, the nurse documents the number of inconsistencies. For instance, a patient who correctly identified name and location but could not identify the time of day, month, weekday, or even year would be charted as A&O ×2. At times, particularly among hospitalized patients, the days may begin to blend together due to the lack of regular sleep schedules, and the patient may be unable to correctly state the date. This does not necessarily mean that the individual is experiencing a change in the level of consciousness. Another question that may help in these instances to thoroughly assess cognition may be why they are hospitalized or being cared for. These four questions, while providing a thorough look at a patient's cognition, are not always able to be answered by healthy patients. Young children and infants are not expected to answer these questions due to their development.

PATIENT CONVERSATIONS

How to Quickly Assess a Patient's Cognitive Status

Scenario: A nurse working at an emergency department assesses a 51-year-old patient who sustained a head injury from a motorcycle accident.

Nurse: Hello, we are bringing you into the emergency department because you had an accident on your motorcycle. Can you tell me your name?

Patient: Carl. Carl Thomas.

Nurse: Okay, Mr. Thomas. Do you know what day it is?

Patient: Friday.

Nurse: Do you know the time of day?

Patient: Nighttime.

Nurse: And do you know where you are right now?

Patient: The ER.

Nurse: Great, we are going to take good care of you here. Do you remember the accident at all?

Patient: No, the last thing I remembered was driving down the interstate.

Scenario follow-up: From this conversation, the nurse was able to assess that the patient was alert and oriented times four, to person, place, date, and time. This is a critical assessment since the patient sustained a head injury.

Other descriptive terms for a patient's level of consciousness are *lethargic*, *obtunded*, *sedated*, and *comatose*. Lethargic means the individual is fatigued, drowsy, and difficult to arouse. Obtunded is used for patients with severe lethargy and lessened response to stimuli. Patients are considered sedated if they are receiving medications to sedate them. A comatose patient is one who is completely unarousable and has no response to stimuli. If a patient is asleep, it may be necessary to wake the patient to determine the level of consciousness, but the nurse may

expect a somewhat slower response from patients if they were just awakened. The Glasgow Coma Scale (GCS) is a frequently used scale in nursing to measure a patient's level of consciousness by assessing eye opening, verbal response, and motor response (Table 15.1). The highest possible GCS score is fifteen, and the lowest is three. A score of fifteen is considered normal, while a score of eight or less is consistent with a severe head injury.

Behavior	Response	Points
Eyes opening	Spontaneously	4
	To voice	3
	To pain	2
	None	1
Verbal response	Oriented	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	None	1
Motor response	Obeys commands	6
	Moves to localized pain	5
	Withdraws from pain	4
	Abnormal flexion	3
	Abnormal extension	2
	None	1

TABLE 15.1 Glasgow Coma Scale

LINK TO LEARNING

How to assess a patient's level of consciousness with the Glasgow Coma Scale (https://openstax.org/r/77glasgowscale) is an important skill for a nurse to learn.

In settings where head injuries or neurological conditions are monitored, the nurse will be required to assess and document the patient's level of consciousness with each vital sign assessment. The **Modified Early Warning Score (MEWS)** is a measurement tool that analyzes the vital sign data and level of consciousness to provide an early warning for deterioration in the patient's status (Table 15.2). A normal score is 0 to 1. With a score of two to three, the nurse would increase the frequency of monitoring vital signs to every two hours and may communicate with the healthcare provider if vital signs do not return to normal with the next assessment. A score of four to six would warrant communication with the healthcare provider and hourly vital sign monitoring. With a score of seven, the nurse would activate the rapid response team. A score of eight is a clinical emergency.

Vital Sign	3	2	1	0	1	2	3
Systolic blood pressure (mm Hg)	<70	71–80	81–100	101–199		≥200	
Heart rate (beats per minute)		<40	41–50	51–100	101–110	111–129	≥130
Respiratory rate (breaths per minute)		<9		9–14	15–20	21–29	≥30
Temperature		<95°F (<35°C)		95°F–101.1°F (35°C–38.4°C)		≥101.3°F (≥38.5°C)	
AVPU (alert to voice, to pain, unresponsive)				Alert	React to voice	React to pain	Unresponsive
Glasgow Coma Scale				14–15	10–13	4–9	3

TABLE 15.2 The Modified Early Warning Score

Other elements used to determine a patient's cognitive status are assessments of facial expression and speech. An abnormality in one or both may indicate a stroke—or cerebral vascular accident—which is a clinical emergency. The acronym BE FAST allows the nurse to assess for signs and symptoms of stroke quickly and provide immediate treatment to prevent lifelong complications and even death (American Heart Association, 2023). Figure 15.3 shows the mnemonic for assessing for signs of stroke.

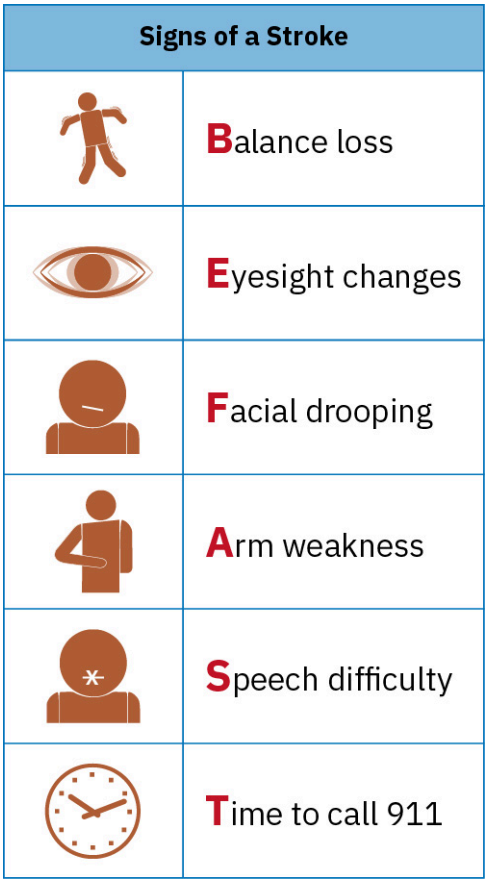

FIGURE 15.3 BE FAST is a valuable mnemonic for stroke symptoms and action. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Recognition of cognition abnormalities may prompt the nurse to perform a more in-depth neurological or mental health examination to determine the problem or collect more data, such as assessing the cranial nerves or asking about medications and illicit drug use.

Another test used when further evaluation of a patient's cognitive status is needed is the Mini-Mental State Examination. This examination is a simple thirty-question test that asks the patient to complete several tasks, such as counting, identifying everyday objects, and writing a sentence to measure cognitive ability or decline.

LINK TO LEARNING

The Mini-Mental State Examination (https://openstax.org/r/77minimental) is an easy-to-use cognitive assessment tool for healthcare providers.

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 1

Mrs. Ramirez, a 68-year-old female, is brought to the emergency room by her husband. The patient reports shortness of breath with exertion and feeling "off" for the last three days.

Past Medical History	Patient reports shortness of breath "gets worse with walking and only gets better after sitting down for at least fifteen minutes." **Medical history:** Myocardial infarction with stents ten years ago, heart failure, chronic obstructive pulmonary disease (COPD), gastroesophageal reflux disease (GERD), and hypertension. **Family history:** Married for fifty years, three grown children. Mother deceased from Alzheimer's. Father alive, with hypertension and prostate cancer, currently undergoing treatment. **Social history:** Former pack/day smoker, quit twenty years ago. Social drinker, one drink/week. **Allergies:** None **Current medications:** • furosemide (Lasix) 40 mg PO daily • lisinopril (Zestril) 10 mg PO daily • carvedilol (Coreg) 6.25 mg PO twice daily • 81 mg aspirin PO daily
Assessment	**1000:** **General survey:** Alert and oriented ×4. Patient appears short of breath and anxious, leaning forward to assist with breathing. Skin is pale.

1. Recognize cues: Based on the information provided, what findings are most relevant to the patient's condition and why?
2. Analyze cues: Based on the recognized cues, what other information should the nurse obtain as part of the general survey?

Nursing Observational and Interviewing Skills

During the first encounter with a patient, the nurse needs to gather pertinent data through vital signs, measurements, observations, and interviewing. To gather the necessary information, the nurse needs to listen to what the patient says, ask appropriate follow-up questions, and observe the patient's behavior. Observation and interviewing skills are the backbone of the nurse-patient relationship. In fact, they are so valuable that the American

Nurses Association (ANA) has included them as one of its eighteen standards of practice (American Nurses Association, 2022).

Nurses must be diligent in attention to both verbal and nonverbal communication expressed by their patients. In addition, nurses must maintain personal awareness of how their own verbal and nonverbal communication is perceived by patients. Utilizing therapeutic communication with patients allows the nurse to delve more deeply into what the patient is saying and helps the patient feel more comfortable with the nurse. It can also help to establish a trusting nurse-patient relationship. For example, if the patient states that they hate it here, a therapeutic response may be, "what aspects of being here do you hate?" or "I am sorry you hate it here. Is there anything I can do to help you feel more comfortable here?" These types of responses are open ended and encourage more dialogue and do not discount the patient's feelings. If the nurse responded with "a lot of patients have given us great ratings," communication and the relationship are hindered.

Active Listening

Another critical skill that nurses need to develop and exercise with every patient interaction is active listening, defined as listening with the intent of understanding and discerning. Active listening can help the nurse assess the patient's situation and concerns. Often, a patient will communicate with the nurse other health concerns that the patient may deem unrelated, but they may actually have a bearing on the treatment plan. These subtle clues may be overlooked if the nurse fails to actively listen. For example, during a first encounter with a patient, there are routine questions a nurse must ask to determine why a patient is seeking care. However, routinely asking these questions of every patient may lead to a nurse simply checking off the task as completed, rather than paying attention to the answers.

It is critical that the nurse use active listening during these conversations. Other times, a patient may go "off script" and begin talking about their family or what happened last year. While this may seem like a rabbit trail for the nurse, the patient could be painting a broader picture of their concerns and adding valuable information that the nurse may have never thought to ask about. The nurse must listen, not just to complete the assigned questions but to understand the patient's concerns. Active listening also is a building block to a trusting nurse-patient relationship because it encourages engagement from both the nurse and patient.

Adaptive Questioning

Adaptive questioning complements active listening. Questioning that echoes a patient's comments is called adaptive questioning. When a patient begins discussing something that seems unrelated to the patient's priority concern, the nurse should follow up with an adaptive question. The best adaptive questions are open ended, not requiring a yes-or-no answer. Adaptive questions could yield information that may have been missed and could even prevent life-threatening consequences. Table 15.3 provides some examples of adaptive questions.

Patient's Statement	Suggested Adaptive Question
"I'm sorry, I wasn't listening because I am tired today."	"Why do you think you are tired today?"
"I don't like the food here. It tastes like metal."	"When did you notice your food tasting like metal?"
"Could I get some more gauze? I'm always changing the dressing because of the drainage."	"How often have you been changing the dressing? Have you noticed the color of drainage?"

TABLE 15.3 Adaptive Questions

PATIENT CONVERSATIONS

How to Use Active Listening and Adaptive Questioning during Conversation

Scenario: A nurse working at a family practice clinic escorts an older adult patient with congestive heart failure from the waiting room.

Nurse: Good morning, how are you doing today?

Patient: Busy, as always. My heart condition keeps trying to slow me down, but I just won't listen.

Nurse: Why do you say that?

Patient: Oh, you know, I get tired easily, and a little short of breath, and my feet have swollen up so much in the last few weeks that I had to buy a shoe the next size up.

Scenario follow-up: Because the nurse was actively listening, the information about the significant swelling was obtained. The nurse may have missed this observation because the patient is wearing shoes. This potentially abnormal symptom requires further investigation by the nurse through adaptive questioning. The main concerns are the worsening of congestive heart failure, such as pulmonary edema.

Nurse: Can you describe the swelling and shortness of breath?

Patient: The swelling's been getting bad the last few days, even after I have been trying to keep my feet up. It goes all the way up to my knees. I even noticed it a little bit on my hands. I just feel like I am about to burst. I've been getting short of breath just taking a shower today and yesterday.

Nurse: Has anything else been bothering you recently?

Patient: I'm just tired. Probably from my stress at work.

Scenario follow-up: From this conversation, the nurse was able to assess that the patient has severe swelling in the legs and feet and some swelling in the hands, fatigue, and shortness of breath. Once these findings are communicated with the healthcare provider, further testing may be required for his condition.

Observation of Nonverbal Communication

Although what a patient says is important, sometimes what is not said can also provide important information. An individual exhibits nonverbal communication through their body language, eye contact, facial expression, and posture. An astute nurse will notice whether the nonverbal communication seems to convey a calm, relaxed disposition or an agitated one. Pain often manifests through nonverbal communication, such as grimacing, restlessness, and guarding movements. The nurse may also be able to tell if the patient is hypoxic simply by observation. Restlessness may be an early sign of hypoxia and should prompt further investigation by the nurse. Observing the patient's nonverbal communication is a critical component of a complete assessment.

Instruments Used for Assessment

Preparing for a patient's assessment requires specialized equipment and instruments. During the assessment process, the nurse must observe, listen, and ask pertinent questions. Vital signs, which are temperature, pulse, respiratory rate, blood pressure, and oxygen saturation, must also be obtained to collect essential data needed for the analysis stage. A thermometer, stethoscope, blood pressure cuff, and pulse oximeter are used to obtain vital signs. Since vital sign equipment comes in a variety of sizes, the nurse should verify that the gathered equipment is appropriate for the patient's age, size, and condition.

To obtain an **anthropometric measurement**, which is a noninvasive quantitative measurement of the human body, the nurse should have access to the appropriate weight scale and height ruler for the patient. Anthropometry tape and skin calipers may also be gathered to obtain other individual measurements. Commonly obtained anthropometric measurements are height, weight, and body mass index (BMI).

Eyes, Ears, and Touch

The nurses' observations are invaluable because the nurse is an experienced professional who can identify subtle cues about each patient. They are like detectives who identify areas of concern from a simple conversation. Their eyes for observation, ears for auscultation, and touch for palpation cannot be replaced. Senses associated with eyes, ears, and touch add a completeness to the assessment that cannot be replaced. The eyes are able to observe the patient's appearance, body language, and behavior. They are also an invaluable tool when counting the respiratory rate. Using the stethoscope, the nurse can assess a beating heart, the patient's breathing pattern and effort, and the blood pressure. Listening is also done through conversing with patients, ascertaining their

perspective on the condition. A handshake or simply applying the blood pressure cuff could let the nurse know the patient's skin temperature and dryness. Palpation could also highlight areas of abnormalities, such as a mass, localized areas of warmth, or pain. The nurse must palpate the pulse to obtain both the heart rate and the blood pressure.

Stethoscope

The **stethoscope** is a piece of medical equipment used to amplify the body's internal sounds to its user (Figure 15.4). It is mostly used to listen to the heart, lungs, and bowel sounds, but it is also used to obtain manual blood pressure. A dual-headed stethoscope consists of a diaphragm, a larger, flat circle, and the bell, the smaller, concave-shaped piece. When the nurse wants to hear low-frequency sounds, such as heart sounds, the bell is placed against the patient's skin. For breath sounds, the diaphragm works best (Figure 15.5).

FIGURE 15.4 A stethoscope allows a practitioner to hear both the heart and the breath sounds. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

FIGURE 15.5 A healthcare provider uses the diaphragm of a stethoscope to auscultate lung sounds. (credit: US Air Force/Wikimedia Commons, Public Domain)

Thermometer

A **thermometer** is used to measure body temperature. A variety of formats exist, such as oral, rectal, axillary, tympanic, and temporal. These types of thermometers are discussed in Temperature. The route of temperature measurement is determined based on the patient's age, cognition, and condition.

Blood Pressure Cuff or Sphygmomanometer

A **sphygmomanometer** is a blood pressure cuff and is used to obtain a blood pressure reading (Figure 15.6). The blood pressure is the pressure of the blood on the arterial walls during the heart's contraction and relaxation. The cuff consists of a long fabric portion that is secured with Velcro over the patient's upper arm. Inside the cuff is an inflatable bladder. With manual blood pressure cuffs, the bladder connects to a bulb that the nurse inflates by squeezing. With the stethoscope in place above the brachial artery, the nurse slowly deflates the bulb as the systolic and diastolic numbers are noted on the dial. The pressure when the first sound is heard over the artery is the systolic blood pressure, while the last sound heard is the diastolic blood pressure. With digital blood pressure cuffs, the bladder connects to a machine and inflates with a touch of a button. After a reading is obtained, the bladder will be deflated.

FIGURE 15.6 Using a manual sphygmomanometer and a stethoscope, a nurse can measure a patient's blood pressure. (credit: Amanda Mills/CDC, Public Domain)

Pulse Oximeter

The **pulse oximeter** measures the oxygen saturation of the blood and the pulse (Figure 15.7). Once it is placed on or wrapped around the fingertip, a light is emitted from one side through the fingertip and analyzed on the other side. By analyzing the light, the pulse oximeter can determine the saturation of the red blood cells. It can be monitored continuously or periodically, depending on the patient's condition and healthcare provider's order. This monitor is either a stand-alone piece of equipment, a component of the vital sign machine, or a component of continuous

monitoring used in patient rooms.

FIGURE 15.7 A handheld pulse oximeter uses a sensor on the patient's finger to measure blood oxygen. (credit: British Columbia Institute of Technology/CCBY 4.0)

Scale, Height Ruler, Anthropometry Tape, or Skinfold Calipers

Many other types of anthropometric measurements are obtained to determine the overall health of an individual. A scale assesses weight either in kilograms or pounds. In the United States, most people measure their weight in terms of pounds; however, in healthcare, kilograms are often used. It is helpful to be able to convert between the two, that is, to record weight in kilograms and provide the patient with their weight in pounds. One kilogram is 2.2 lb, and 1 lb is 0.45 kg. Height is another measurement that should be obtained. A height ruler is often attached to a standing scale to ease with the attainment of both weight and height. In the United States, most are familiar with measurement of length—and height—in feet and inches, whereas centimeters are used in health care. Rulers used in healthcare provide measurements in both numbers side by side.

Another useful tool to determine body circumferences is **anthropometry tape**, a flexible measuring tape. For infants and toddlers, it is used to measure serial head and chest circumferences, which are important in tracking proper rate of growth (Figure 15.8). Measuring the waist, hips, and limb circumferences in adults is also helpful to determine the amount of adipose tissue and provide a baseline for further measurements. The waist circumference is a particularly useful measurement of central adiposity. Increased central adiposity increases the risk of heart disease and diabetes (Casadei & Kiel, 2022).

FIGURE 15.8 Anthropometric tape is used to measure an infant's head circumference. (credit: Airman st Class Anania Tekurio/Wikimedia Commons, Public Domain)

To assess the thickness of skinfolds at various areas of the body, **skinfold calipers** may be used (Figure 15.9). Although this measurement is intended to determine nutritional status, measurements with this tool commonly provide inconsistent results, leading to infrequent use. Common sites to measure skinfolds include the back of the upper arm, hips, abdomen, thighs, and chest (Casadei & Kiel, 2022).

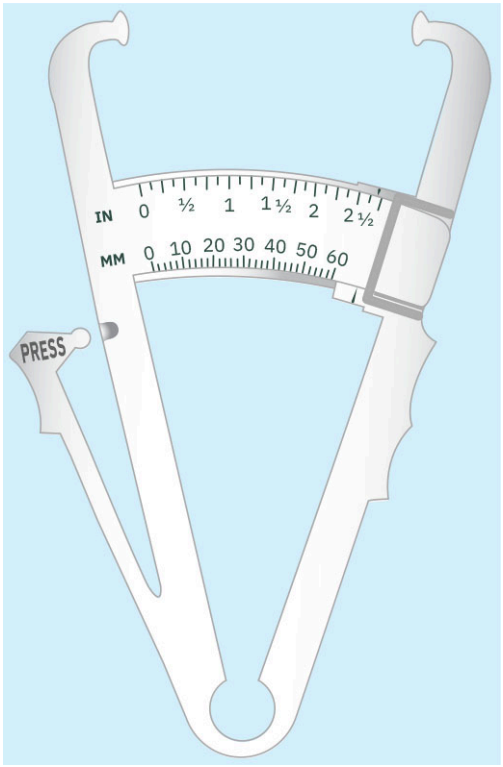

FIGURE 15.9 Skinfold calipers include measurements in both inches and millimeters. (attribution: Copyright Rice University, OpenStax,

under CC BY NC-SA 4.0 license)

15.2 Common Types of Anthropometric Measurements

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the different scales used to obtain a patient's weight
- Differentiate instruments used for measuring a patient's height
- Identify normal and abnormal ranges for body mass index

A component of the generalized survey of patients is obtaining anthropometric measurements. Consideration of individual circumstances will help the nurse determine which methods should be utilized to obtain these measurements. For example, a bedridden patient requires more assistance from healthcare professionals than would be needed for a mobile patient, and the nurse may need to use lifts, wheelchairs, and transfer devices. The nurse needs to not only obtain these measurements but also interpret their meaning. By analyzing the results, the nurse should be able to determine whether patients are underweight or obese and provide personalized care for them. However, it is more than just determining whether they are over- or underweight. Height is also used to assess growth trends (i.e., increased height in children or decreased height in older adults).

Weight Measurement

Weight is a crucial anthropometric measurement that is routinely assessed to provide information regarding health status, treatment effectiveness, and medication dosages. Generally, in adulthood height changes very little, while weight can fluctuate due to a multitude of physiological conditions. Common physical conditions that require daily weight checks are cardiac, endocrine, and renal conditions. Mental conditions, such as depression, may also cause weight loss or weight gain. Frequent monitoring of weight can show the progress and effectiveness of the prescribed treatments.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Anthropometric Measurements

See the competency checklist for Anthropometric Measurements. You can find the checklists on the Student resources tab of your book page on openstax.org.

Some medication dosages are dependent on an individual's weight—for example, those prescribed as part of chemotherapy—and most pediatric medications are weight based. Depending on the setting (e.g., critical care versus an outpatient clinic) and patient condition, weight may be monitored daily, weekly, or just upon admission. Weight is also monitored at outpatient appointments. Patients with illnesses such as heart failure or kidney failure might have daily weight to monitor disease progression or management. Weight can be assessed using a variety of equipment, such as a traditional standing scale, a bed scale, a sling scale, and a bariatric scale.

PATIENT CONVERSATIONS

What If Your Patient Is Reluctant to Get on the Scale?

Scenario: A nurse working at the family practice clinic escorts back a patient with a history of myocardial infarction and acute coronary syndrome. The patient is being seen for an annual physical.

Nurse: Good morning, Mr. Tanner. Before I bring you back to your room, I need to get your weight right over here.

Patient: Oh, I weigh myself weekly. I'm always between 220 to 225 lb (99.8 to 102.1 kg).

Nurse: That's good to know. It sounds like you're monitoring your weight regularly. Okay, go ahead and remove your coat and step up on the scale.

Patient: I already told you what I weigh. Why do I need to get weighed again?

Nurse: We just need an exact weight to monitor your health and response to treatment.

Patient: Okay, if you must.

Scenario follow-up: From this conversation, the nurse was able to communicate the importance of obtaining a weight prior to a healthcare visit.

Standing Scale

The standing scale is used for ambulatory patients (able to stand and/or walk) in a variety of settings, such as the healthcare provider's office, long-term care facilities, hospitals, and homes. To use this scale, the patient will have to step up onto the scale and be stable without holding on to anything. With digital models, the weight will automatically appear. With manual standing scales, the nurse will need to adjust the sliding weights until the balance bar is level, as indicated by needle on the right side of most models (Figure 15.10).

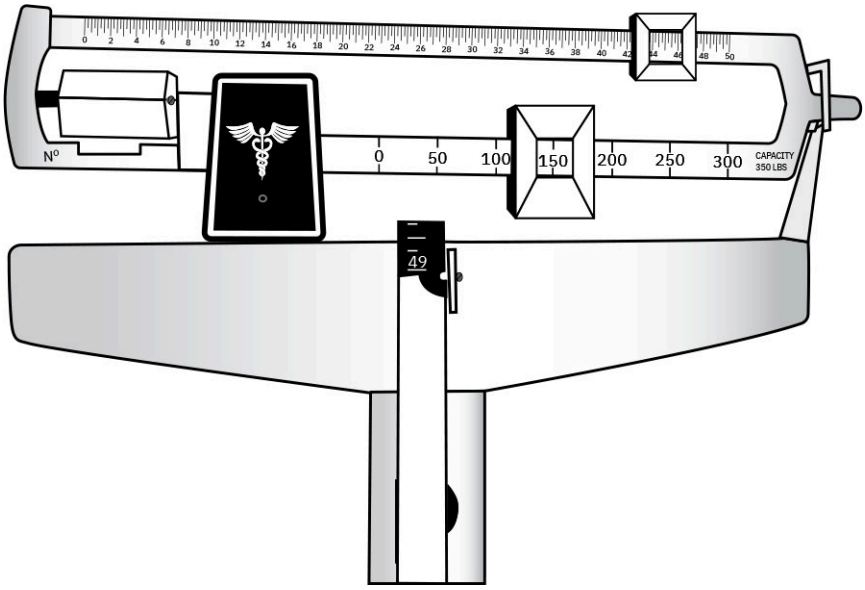

FIGURE 15.10 To determine weight from a manual sliding scale, you must add up all of the weights indicated when the balance bar is level. In the image (far right), the bar is touching and needs to be adjusted until it is balanced midway in the space. (credit: Carol Clarkson, donated)

Bed Scale

For patients who cannot stand or on bed rest, a **bed scale** may be used. These scales are embedded within most hospital beds. To use this type of scale, the nurse will need to "zero out" the bed, which must be done with the patient out of bed. Zeroing out the bed means that the weight of the bed with the linens is set to zero so that when the patient returns to the bed, the scale provides only the patient's weight. This can be accomplished prior to admission, lifting the patient out of bed with a lift, or done while the patient is out of bed for toileting, procedures, or treatments.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Using a Portable Bed Scale

See the competency checklist for Using a Portable Bed Scale. You can find the checklists on the Student resources tab of your book page on openstax.org.

Sling Scale

A **sling scale** is used for completely immobile or unsteady patients. A sling, or piece of large fabric, is placed under the patient, often by two healthcare personnel. Both ends of this fabric have a metal hook that connects to the sling scale. As the patient is lifted out of bed with this scale, weight is obtained. The sling scale is mostly used in long-term care settings and on acute inpatient units rather than in critical care settings. Even though many patients in

critical care are immobile, the use of a sling scale would be difficult and even detrimental to use due to the multiple lines, tubes, and equipment needed for those patients.

Bariatric Scale

Sometimes patients do not fit into the traditional parameters of what a basic scale can measure, for instance, they may exceed the limit that can be measured, or do not fit in a particular area where the standing scale is stationed. In these situations, a specialized scale should be used to accurately measure the patient's weight. Most acute care facilities are equipped with both traditional and bariatric scales. The **bariatric scale** is used for patients who weigh more than 350 lb (159 kg). Bariatric scales are wider and sturdier than traditional standing scales and can measure weight accurately to 1,000 lb (454 kg), or more.

Height Measurement

Height is another measurement that aids in developing a complete picture of the individual. When combined with the patient's weight, it shows if the patient is underweight, overweight, or obese. A decrease in an adult's height is also an indicator of bone degeneration, particularly of the vertebrae. For inpatient status, height is obtained just once, upon admission. Height is also checked yearly at primary care appointments.

Stadiometer

For most people, height is measured while the individual is standing using a **stadiometer**. The individual stands in front of the vertical stadiometer, back against wall, heels up against wall, head straight. The top horizontal bar will manually adjust to the individual's height and rest on top of the head (Figure 15.11). When it is adjusted, the height measurement will be found near the top of the stadiometer.

FIGURE 15.11 A patient's height is measured using a stadiometer. (credit: Carol Clarkson, donated)

Demi-Span for Bedridden Patients

For those individuals who are unable to use the stadiometer because of physical restrictions, a nurse can use a formula and the demi-span measurement to estimate the height. The **demi-span** is the distance in centimeters from the center of the suprasternal notch (Figure 15.12) to the tip of the middle finger while the arm is straight to the side at a 90-degree angle to the body. The measurement is then entered into one of the following formulas to determine the patient's height.

Females: Height (cm) = (1.35 × demi-span [cm]) + 60.1

Males: Height (cm) = (1.40 × demi-span [cm]) + 57.8

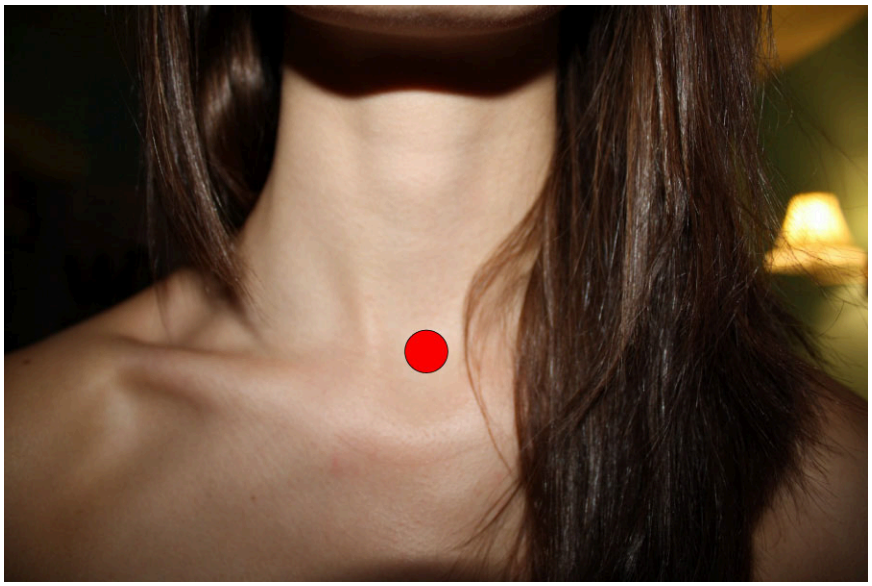

FIGURE 15.12 The suprasternal notch is the starting point for obtaining the height using the demi-span method. (credit: modification of work by "danabooo"/Wikimedia Commons, CCBY 2.0)

Other less commonly used methods to determine height in bedridden patients include analyzing the knee height and analyzing the forearm length. The knee height, from the top of the knee to the sole of the foot, is measured in centimeters while the knee is flexed at a 90-degree angle. The forearm length, which is essentially the length of the ulna, is also measured in centimeters. These results are then entered into a formula to determine the height (RxKinetics, 2023).

Body Mass Index

The **body mass index (BMI)** is a value that is calculated from an individual's height and weight. Computation of BMI begins at approximately two years old. To calculate BMI, the nurse must first obtain a patient's weight and height. These numbers should then be placed into one of the following formulas:

$$\text{BMI} = \text{Weight (kg)}/\ (\text{Height[m]})^2$$

$$\text{BMI} = \text{Weight (lb)}/\ (\text{Height[ft]})^2$$

Most healthcare charting systems will automatically calculate a patient's BMI once the height and weight are entered. Multiple BMI calculators are also available on the internet, and BMI charts are located in many healthcare facilities to aid with this calculation (Figure 15.13). The nurse can also manually find the intersection of the height and weight on the chart.

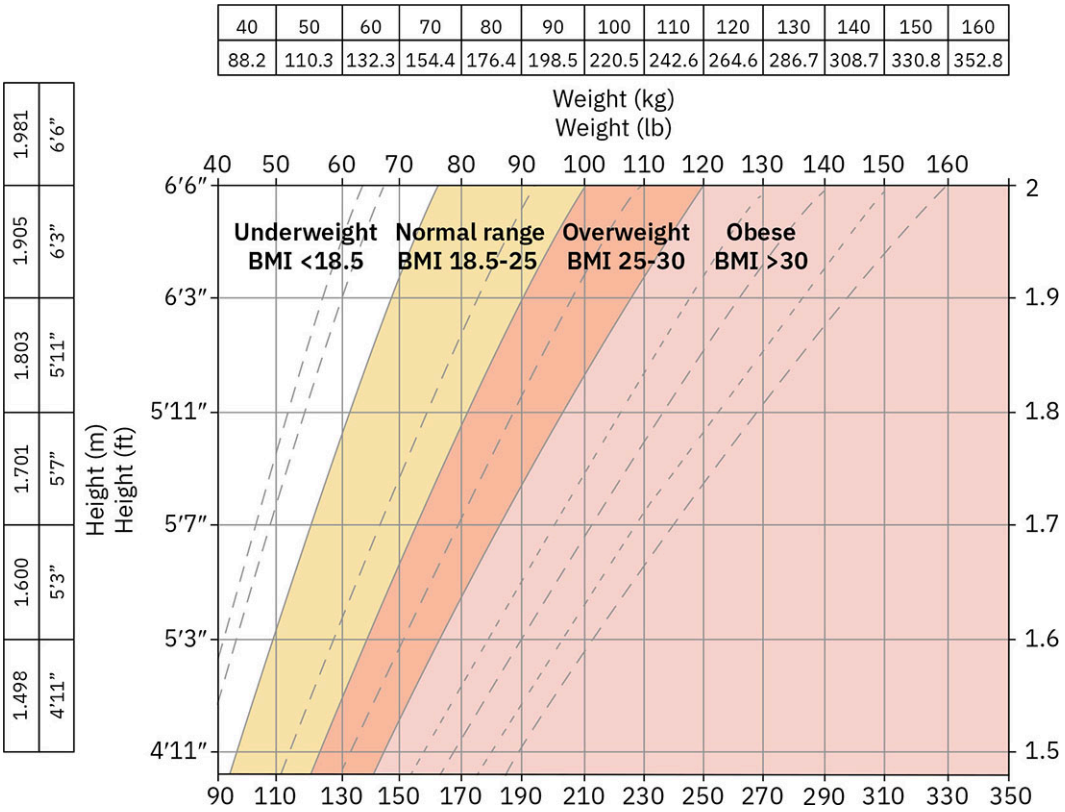

FIGURE 15.13 This BMI chart shows the correlation between height and weight and BMI levels. (credit: modification of work from *Psychology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

BMI is then classified as underweight, healthy, overweight, obese, and severely obese. The healthy range for weight is a BMI between 18.5 and 24.9. A BMI below 18.5 is considered underweight, whereas a BMI of 25 to 29.9 is considered overweight. Obesity is defined as a BMI equal to or greater than 30, and severe obesity is a BMI equal to or greater than 40. It is important for the nurse to note that BMI can be impacted by the patient's background and activity, because body fat distribution differs by race and ethnicity, such as among Hispanic, Black, East Asian, and South Asian populations. Furthermore, BMI metrics are based on anthropometric measurements of White people. As a result, BMI should be used in conjunction with other assessment findings to recognize weight concerns. For example, muscle is more dense than fat. Therefore, a body builder may have the same BMI as someone who would be classified as “obese” according to the BMI calculation and not be truly considered “obese.”

15.3 Vital Signs

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the steps involved for preparing to obtain vital signs
- Understand how and when to monitor vital signs
- Discuss the importance of using critical judgment when validating data
- Explain proper techniques for documenting data

A **vital sign** is a marker of physiological homeostasis and are essential in the analysis of monitoring patient progress. Vital signs include the body temperature, pulse, respiratory rate, and blood pressure. Vital signs are gathered during the initial encounter with the patient to establish a baseline and routinely thereafter, according to condition, to assess disease progression or resolution. When vital signs are abnormal, a patient’s plan of care is typically altered. When vital signs are taken routinely, the healthcare team can analyze them to observe the response to treatments or disease progression. The combination of multiple vital sign measurements over a period of time also provides the typical and normal ranges for an individual patient. These individualized ranges are the vital sign trends. The vital signs provide a snapshot of the circulatory, respiratory, and neurological status of the patient.

Preparing to Obtain Vital Signs

Prior to obtaining vital signs, the nurse should gather the necessary equipment, check the patient's vital sign trends and pertinent history, and verify the healthcare provider's orders regarding frequency and parameters. To complete the vital signs, the nurse must obtain a thermometer, stopwatch, stethoscope, pulse oximeter, and blood pressure cuff. Many of these items may be present on the facility's vital sign machine. Some facilities keep designated vital sign equipment at the patient's bedside. At times, vital signs are obtained via an electronic monitoring device either continually (such as in critical care units) or scheduled (Figure 15.14). When these devices are used, it is the nurse's responsibility to manually collect the data received.

FIGURE 15.14 A vital sign machine shows a patient's pulse, heart rate, and blood pressure. (credit: Senior Airman Callie Norton/McChord, Public Domain)

Reviewing the patient's vital sign trends could provide valuable information for the nurse. For example, if the patient's health record indicates that their heart rate is typically around 65 beats per minute, then the nurse checks it and finds it to be 96 beats per minute, further investigation may be warranted. Although this value is normal for the population in general, it is not normal for that patient.

Health history may influence obtaining vital signs. For example, a mastectomy would prevent the nurse from obtaining blood pressure on that arm due to the risk of lymphedema, and a wound might prevent placement of blood pressure cuff. Oral trauma would change the route of obtaining the temperature, and a wound over the wrist may interfere with the palpation of a pulse. Being prepared prior to entering the room will prevent errors.

LIFE-STAGE CONTEXT

Older Adults and Normal Temperature Ranges

The normal temperature range in older adults tends to be on the lower end of the normal adult temperature ranges. As we age, our metabolic rate gradually decreases which, in turn, causes a gradual decline in our temperature. When caring for an older adult, a temperature on the high end of normal could indicate a fever, and even a serious infection, since their trends are lower (Hernandes Júnior & Sardeli, 2021).

Monitoring Vital Signs

The frequency at which a nurse should obtain vital signs is determined by the stability of the patient, facility protocols, and healthcare provider orders. Heart rate, respiratory rate, blood pressure, and oxygen saturation may be monitored continuously in critical settings or with patients who are unable to manage their airways or sufficiently perfuse their body. It is important to note that the nurse can use nursing judgment to recheck vital signs at any time despite the frequency noted in the orders. The orders indicate the minimum frequency by which the nurse should take the patient's vital signs. Any change in the patient's status such as a new complaint or new assessment finding would prompt the nurse to obtain a set of vital signs. Whenever a nurse feels that the practitioner needs to be updated on the patient's status, the nurse should obtain a complete set of vital signs to communicate a thorough picture of the patient to the practitioner.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Change in Patient Status

A nurse is caring for a gentleman recovering from a total knee replacement, postoperative day 2. The healthcare provider has ordered vital signs every four hours, physical therapy, pain medications, and a resumption of home medications. Since surgery, he has been doing well in physical therapy, and his pain has been controlled with IV ketorolac (Toradol) and oral acetaminophen (Tylenol). He last received ketorolac at 0430. His last set of vital signs were obtained two hours ago at 0400:

- Temperature 98.1°F (36.7°C)
- Pulse 68 beats per minute
- Respiratory rate 16 breaths per minute
- Blood pressure 119/58 mm Hg

This morning, he stated that his pain has been getting worse, not better, since his last dose of pain medicine. He also asked for Tylenol for a headache.

After noting the change in the patient's condition, the nurse needs to take action. Even though it is not time to obtain the ordered vital signs, nursing judgment dictates the need to get another set of them. The vital signs are as follows:

- Temperature 99.8°F (37.7°C)
- Pulse 84 beats per minute
- Respiratory rate 22 breaths per minute
- Blood pressure 132/64 mm Hg

After administering the dose of acetaminophen, the nurse contacts the healthcare provider to report the change in the patient's condition and the updated vital signs.

Postoperatively, vital signs are monitored according to a facility's protocol, with more frequent vital signs obtained initially after the procedure, which then is progressively spaced out to the unit protocol frequency (Table 15.4). This postoperative protocol is used because of the anesthesia and medication's effects and the nature of the procedure. Anesthesia and medication may cause respiratory depression and other reactions, among other complications. The procedure itself could have caused bleeding or damage to a body area. More frequently measured vital signs may show subtle changes, which can then be used to determine the healthcare team's course of action.

Protocol	Time	Data
Immediately	1015	
Every fifteen minutes for the first hour	1030 1045 1100 1115	
Every thirty minutes for two hours	1145 1215 1245 1315	
Every hour for four hours	1415 1515 1615 1715	
Revert to unit protocol's or healthcare practitioner's orders		

TABLE 15.4 Example of Postoperative Vital Sign Orders

Consider this scenario: A patient has arrived from the operating room after an emergency appendectomy. The unit postoperative vital sign protocol is as follows: Obtain vital signs on arrival to the unit, then every fifteen minutes × one hour, every thirty minutes × two hours, every hour × four hours, every four hours throughout admission. Following is an example of why vital sign monitoring is so important in discovering subtle changes and performing interventions to prevent complications.

Time	Data	Observations/Interventions
1015	HR 67, BP 108/62, O_2 98, RR 14	Patient sleepy; arrived to unit
1030	HR 72, BP 112/68, O_2 98, RR 18	Wife at bedside
1045	HR 82, BP 120/74, O_2 98, RR 20	Patient reporting pain; pain meds given
1100	HR 64, BP 102/58, O_2 94, RR 12	Patient resting with lower O_2 and RR; order obtained for 2 L O_2 via nasal cannula
1115	HR 66, BP 108/62, O_2 95, RR 14	Patient resting comfortably
1145	HR 76, BP 112/68, O_2 95, RR 16	Patient reporting pain; nonpharmacological interventions done
1215	HR 72, BP 110/68, O_2 95, RR 16	Patient resting comfortably

Time	Data	Observations/Interventions
1245	HR 70, BP 108/64, O_2 92, RR 14	Patient encouraged to use incentive spirometer/cough and deep breathe
1315	HR 76, BP 112/64, O_2 92, RR 12	Practitioner made aware of O_2 saturation; nasal cannula increased to 4 L O_2
1415	HR 74, BP 110/62, O_2 94, RR 14	Reinforced the importance of incentive spirometer use; raised the head of the bed for better lung expansion
1515	HR 78, BP 112/62, O_2 96, RR 16	Encouraged continuation of incentive spirometer use; nasal cannula decreased to 2 L O_2
1615	HR 76, BP 107/62, O_2 96, RR 16	Encouraged continuation of incentive spirometer use
1715	HR 78, BP 110/68, O_2 97, RR 16	Encouraged continuation of incentive spirometer use

Through vital sign monitoring, the nurse was able to identify possible postoperative atelectasis (partial collapse of the lung from anesthesia) and begin interventions to halt progress into possible pneumonia.

Different settings and their protocols may also affect the frequency of the vital signs. In intensive care units, which are those units where the patients are in critical condition, even more frequent assessment may be necessary depending on patient condition and medications. In long-term care settings, vital signs are obtained every eight to twelve hours. In home health environments or when individuals are instructed to monitor their vital signs at home, they are typically done once each day and at the same time each day. Doing them at the same time each day helps the individual to make monitoring vital signs a habit. Another reason to do them at the same time each day is to prevent fluctuations due to the individual's normal routine and time of day. Heart rate would be expected to be lower first thing in the morning and higher as the day progresses.

If there is a change in a patient's condition, the nurse must obtain another set of vital signs, even if the last set was obtained only one hour prior. Changes in the patient's condition refer to something experienced by the patient or observed by the nurse or family members—that is, anything that is concerning to any of the parties. The checked vital signs can help to alleviate the patient's or family's fears, but they may also provide the data that need to be conveyed to the healthcare provider to determine the next actions.

Validating Data

After the nurse obtains vital signs, it is imperative to compare these against the normal ranges for the patient's age and the patient's trends. Generally, if the results fall within both ranges, the vital signs are documented according to protocol. If the results fall outside of the normal ranges or the patient's trends, the nurse will need to validate them, that is, to repeat the measurement of the vital sign in question. At times, these abnormal results reflect the clinical situation of the patient, but at other times, the abnormalities may be a result of operator or equipment error.

When an abnormal vital sign is obtained, whether outside of the normal ranges or outside of the patient's trends, the nurse should recheck that vital sign. If the temperature reading is abnormal, the nurse may try another thermometer or use another route. Changing equipment will allow the nurse to ensure that the abnormal reading was not caused by equipment malfunction. If the equipment malfunction is noted, the nurse should report it, take the equipment out of use, notify biomed/tech to check the equipment, and label the equipment as "do not use."

The nurse may also just have to verify that the steps were completed accurately in obtaining the temperature. For an abnormal blood pressure reading, it may be necessary to recheck on the opposite arm. Automatic and digital vital sign equipment has preset limits for results it is able to provide. For example, some digital thermometers will give an

error screen if the result is greater than 105°F (40.5°C). If a patient's results are outside of these limits, a manual method for obtaining that vital sign will be necessary. Any abnormal results warrant a reassessment of that vital sign. The nurse must also assess the patient for any signs of distress or deterioration. There are times when abnormal results do not indicate an emergency or need for intervention. Vital signs may be abnormally high when the patient is excited, nervous, or has experienced physical activity, such as physical therapy. They also may be lower due to the comforting presence of family or friends.

Documenting Data

After vital signs are obtained and validated, the nurse must document these results. Most healthcare facilities use the electronic health record for patients, but some facilities still use paper flowsheets. Documentation is required to track the patient's trends and response to treatments and to communicate with the healthcare team. For temperature, the nurse will chart the degrees in Fahrenheit or Celsius (according to agency policy) and the method used to obtain the temperature (i.e., oral, axilla, tympanic). When charting the pulse, the result will be in beats per minute. The nurse will also document the site or method used for the pulse (i.e., radial pulse or continuous pulse oximeter). The respiratory rate will be documented in breaths per minute, and the method of assessment should be noted (i.e., visual or stethoscope). Blood pressure requires two numbers to be documented, the systolic and the diastolic pressures. The nurse will also specify which extremity was used and if the blood pressure was manually or automatically obtained. For an abnormal result, whether the charting system flags the vital sign or not, the action should be documented. For example, the action may be that a medication was administered, that the patient's position was changed, or that the healthcare provider was alerted.

15.4 Temperature

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Differentiate optimal from other temperature ranges for patients
- Describe the types of thermometers used to obtain patient temperature
- Identify factors affecting patient temperature

Body temperature reflects the balance between heat produced and heat lost. Heat is produced in the body during muscle movement and the normal physical and chemical process, called metabolism. A patient's temperature is one of the four main measurements routinely monitored to determine function of the body, along with heart rate, respiratory rate, and blood pressure (Johns Hopkins Medicine, 2023). A patient's body temperature is considered a vital sign, meaning that it can provide the nurse with critical or vital information. Temperature provides clues to other body systems, and or processes for maintaining homeostasis, such as the presence or absence of an infection, a functioning hypothalamus, and an effective integumentary system. Temperature is measured in either degrees Fahrenheit (°F) or degrees Celsius (°C). In the United States, the Fahrenheit scale is mostly used, and patients are most familiar with thinking of temperature in terms of Fahrenheit degrees. In health care, both Fahrenheit and Celsius measurements are documented (Table 15.5).

Fahrenheit	Celsius
97°	36.1°
98.6°	37°
99°	37.2°
100.4°	38°

TABLE 15.5 Fahrenheit to Celsius Equivalency

Fahrenheit	Celsius
102°	38.9°
104°	40°

TABLE 15.5 Fahrenheit to Celsius Equivalency

The body is able to maintain a normal temperature through a variety of governing biochemical mechanisms, but at times, these mechanisms may behave in ways that cause abnormalities that require treatment. Intact skin, metabolism, and brain function all aid in temperature regulation. When one of these features becomes impaired or stretched beyond its limits, temperature maintenance, among other processes, is lost. To determine if the temperature is in the normal range, the nurse uses a thermometer to obtain a reading. Because of the variety of thermometers available, the nurse can choose the best one for the patient.

CLINICAL JUDGMENT MEASUREMENT MODEL

Generate Solutions: Choosing the Right Thermometer for the Patient

A nurse is caring for a patient in the emergency department who had wisdom teeth extracted a week ago. The patient came to the emergency department for a two-day history of fevers, chills, and drainage from oral wounds. The nurse is preparing to obtain the initial set of vital signs. After analyzing the presenting symptoms, the nurse obtains the axillary thermometer rather than the more commonly used oral thermometer because of the patient's recent procedure and oral complications.

Temperature Ranges

Targeted temperature management is an average overall scale with normal fluctuations, which can range between 97°F and 99°F (36.1°C and 37.2°C). The targeted range for body temperature is referred to as normothermia. Fluctuations occur within normothermia due to circadian rhythm, metabolism, and hormones. For instance, circadian rhythm refers to the body's natural ability to lose heat in the extremities due to naturally occurring vasodilatation of the cutaneous vasculature during sleep-wake cycles. Changes in body temperature naturally drop between the hours of 3 and 5 a.m. and again between 1 and 4 p.m. Times of high metabolic activity increase temperature because of the increase in chemical reactions producing heat within the body. Exercise, infection, and hyperthyroidism are all examples of increased metabolic needs. Fluctuations of the thyroid hormone affect metabolic activity as well, meaning that an increase in thyroid hormone will increase the temperature (Whitmer, 2021).

The body's ability to maintain its temperature within normal ranges is called thermoregulation. The hypothalamus is responsible for thermoregulation and is an endogenous, or internal, mechanism of heat regulation. For example, if the body's temperature is increasing, the hypothalamus will detect this change and increase blood flow to the body's surface, which in turn activates the sweat glands, inducing perspiration. If the body's temperature is decreasing, the hypothalamus will induce shivering to create more heat (Figure 15.15).

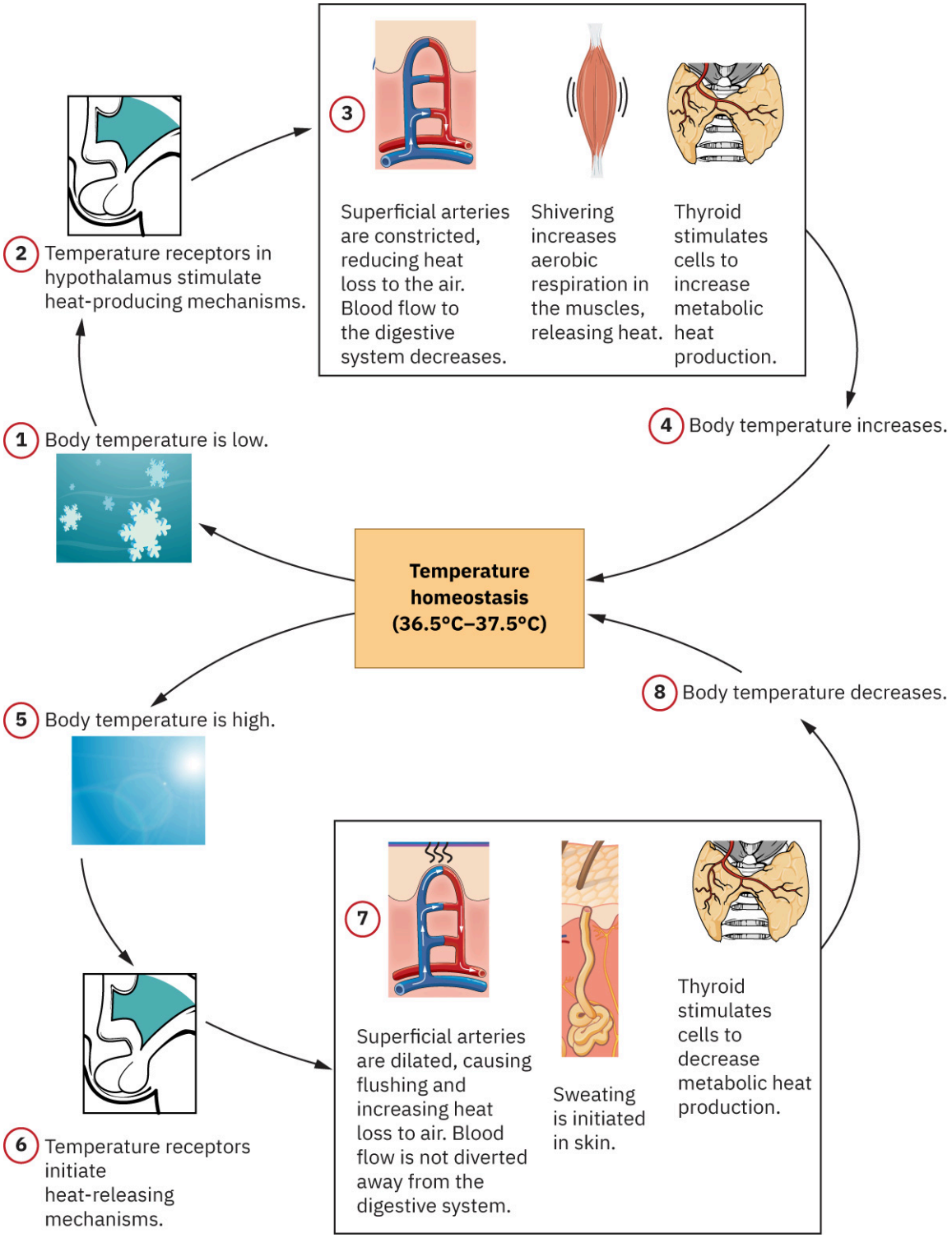

FIGURE 15.15 The hypothalamus is responsible for thermoregulation and homeostasis. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

When temperatures are markedly outside of normal ranges, they are considered either hyperthermia or hypothermia. When the core body temperature is more than 105.8°F (41°C), **hyperthermia** occurs. When the temperature is less than 95°F (35°C), it is known as hypothermia. These conditions are the result of exogenous factors (variables outside the body's control), such as the environment, not the result of the hypothalamus. Cold water and very cold or very hot air temperatures are just some examples of exogenous (outside the body) environmental factors that affect temperature.

Mechanisms of Heat Transfer

Heat is transferred from areas of higher temperatures to lower temperatures. When heat is transferred, it may affect temperature. For example, after exercising, which causes a small increase in body temperature, an individual may take a cool shower, which can lower the temperature due to heat transfer. Figure 15.16 illustrates the four methods of heat transfer, using a newborn as an example: conduction, convection, radiation, and evaporation (Whitmer, 2021).

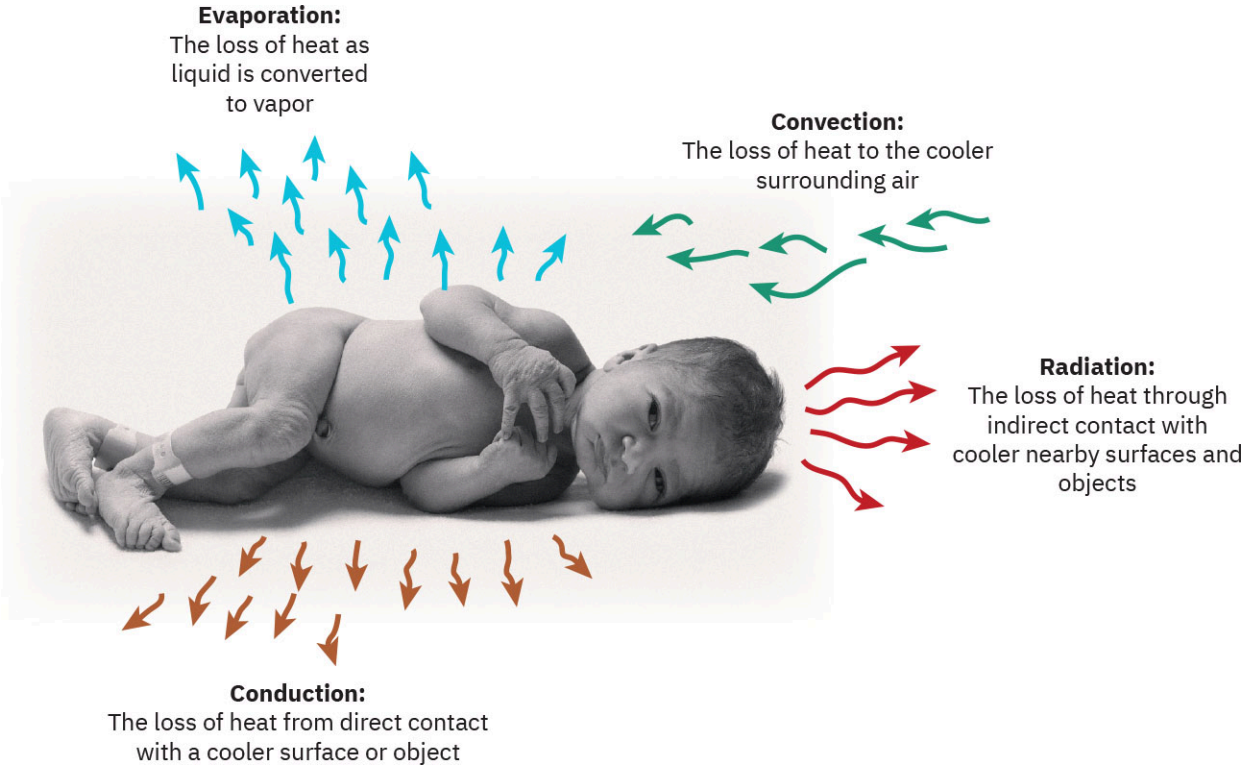

FIGURE 15.16 This image explains the mechanisms of evaporation, convection, radiation, and conduction during heat transfer. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Conduction

When heat is transferred between two objects in direct contact, **conduction** occurs. Heat is given off in waves through the surface of the body. An example of conduction is when a heating pad is used to warm muscles, or when the body transfers internal heat to an ice pack and melts the ice. Conduction is an important process in heat transfer because it allows instant lowering of the body temperature but only allows approximately 3 percent of heat loss. This means the body can transfer excessive heat from one selected area to another. For example, a burned hand with an ice pack placed on it allows heat to be transferred, not losing more than 3 percent of the body's overall heat. Nurses can alter the environment to increase heat transfer through conduction by providing interventions such as cool or tepid sponge baths, cool packs, and cooling blankets.

Convection

Another mechanism of heat transfer is **convection**. It occurs through air or water currents. An example of convection is the internal heat lost using a ceiling fan, which circulates air currents. Heat is also lost through this method by cold and windy environmental conditions. Convection permits heat loss of as much as 15 percent. Nurses may use convection to alter the patient's environment through the use of a fan, air conditioner, or heater.

PATIENT CONVERSATIONS

How Does Convection Affect an Intoxicated Person?

Scenario: An experienced nurse is precepting a nursing student in the emergency department when emergency medical services brings in a hypothermic patient found passed out at the bus stop at 2 a.m. It is early spring, and

the temperature that night dipped to 47°F (8.3°C). The patient is unconscious and only wearing an undershirt and pants. The patient's jacket was found on the bench. The blood alcohol level is extremely elevated at 0.27, while the core body temperature is 92°F (33.3°C).

Nurse: Do you know that alcohol intoxication can actually make a person more susceptible to hypothermia?

Student Nurse: I thought it made you warmer.

Nurse: It does make a person feel warmer which is actually dangerous. People feel so warm that they remove their clothing, even when it is too cold outside.

Student Nurse: Okay, yes, that makes sense, and then they lose heat due to convection. I was just studying that for the NCLEX.

Scenario follow-up: From this conversation, the nurse was able to educate the student nurse on the life-threatening nature of convection heat loss that occurred because of the removal of clothing in cold weather.

Radiation

Heat transfer through infrared waves is called **radiation**. It can account for as much as 60 percent of heat loss, the most of the heat transfer methods. For example, an individual may be outside on a warm day but, due to radiation, have vastly different experiences depending on, for example, where they are situated. For instance, standing in the sun allows the sun's infrared rays to transfer heat to the individual and increase body temperature. In contrast, standing in the shade prevents these infrared rays from reaching the individual, causing the temperature to remain the same. Radiators are an example of radiation used to provide heat in homes. Nurses can alter the environment in clinical settings by utilizing a heat lamp or placing a newborn under a radiant warmer (Figure 15.17).

FIGURE 15.17 A radiant warmer uses heat transfer via radiation to maintain a newborn's temperature. (credit: Eglin Airforce Base, Public Domain)

Evaporation

The transfer of heat through the change of water from a liquid to vapor is evaporation, another method of heat transfer that people experience daily. The human body utilizes this mechanism through perspiration. Other examples of its use to lower temperature are stepping out of a pool or shower and needing to reach for a warm towel. The rate of evaporation and subsequent cooling is often related to the environmental humidity. For example, when comparing moderate temperatures and air humidity in a very humid environment, the rate of evaporation and cooling is decreased, whereas in a dry environment, the rate is increased. Evaporation accounts for as much as 20 percent of heat loss (White, 2021).

Fever Processes

Fever, also known as **pyrexia**, is defined as an elevated body temperature triggered by the hypothalamus. It is a sign of disease. Infection, inflammation, malignancy, and autoimmune conditions cause fever through a **pyrogen**, or fever-inducing substance. Once a pyrogen is detected, the hypothalamus triggers a fever to defend the body. With an increase of just 33.8°F (1°C), the body increases the metabolic rate by 10 to 12 percent. This increased metabolic rate, in turn, requires an increase in the oxygen demand that increases the heart and respiratory rate. Protein, instead of bacteria-loving glucose, is the preferred source of energy. The immune system also is bolstered, evidenced by increased white blood cell activity, interferon production, and T-cell activation. This elevated temperature also discourages the growth of microbes, which grow best at normal body temperatures. Pyrexia may also occur due to exercise, and an elevated temperature may be affected by the patient's gender, age, or emotions. Time of day also correlates to temperature changes.

PATIENT CONVERSATIONS

How Do You Explain Metabolic Rate and Temperature Changes to Patients?

Scenario: A nurse, working at an urgent care clinic, escorts a patient who has been complaining of daily low-grade fevers.

Nurse: What brings you in today?

Patient: Well, I haven't felt sick, but I've been having low-grade fevers every day for over a week.

Nurse: Anything else going on?

Patient: No, nothing I can think of.

Nurse: How high did your temperature get?

Patient: 100.8°F (38.2°C).

Nurse: What prompted you to take your temperature?

Patient: Well, one day after my run I was feeling kind of shaky, and my temperature reached 100°F (37.8°C). It kind of scared me, but when I took it later that day, it was fine. Then I took it the next day, and it was still up. So, I started taking it every morning just to check. I don't know, it got me worried. My sister said fevers could be a sign of cancer, so I wanted to get it checked out, just in case.

Nurse: Have you still been running every day?

Patient: Yes, I have been feeling okay.

Nurse: And do you usually take your temperature after you run?

Patient: Yes, that's when I remember.

Nurse: I will be sure to let the healthcare provider know about your concern. She should be in shortly to examine you, but I did want to point out that sometimes your temperature will rise when your metabolic rate increases, or the speed at which your body converts energy. Running, really any kind of exercise, will increase your metabolic rate and your temperature.

Scenario follow-up: From this conversation, the nurse was able to educate the patient about the direct relationship between the metabolic rate and temperature.

Although fevers increase the survival rate from infections, they are quite uncomfortable due to the body aches, chills, and **diaphoresis** (sweating) that they cause. Because of the increased metabolism seen when fevers develop, tachycardia (elevated heart rate), **piloerection** (goosebumps), and flushed skin also occur (Table 15.6). A severely elevated fever, although rare, can be lethal.

Subjective Findings of Fever (Symptoms)	Objective Findings of Fever (Signs)
Night sweats	Diaphoresis
Shivering or shaking	Tachycardia
Achiness	Piloerection (goosebumps)
	Warm, flushed skin

TABLE 15.6 Subjective and Objective Findings of Fever

A medication that alleviates a fever is called **antipyretic**. Common antipyretics are acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDs), such as acetylsalicylic acid (aspirin) and ibuprofen. Although these medications do lower a fever, that might not always be desired since the presence of a fever means that the body is fighting off the pyrogen, but when a fever becomes uncomfortable or very elevated, an antipyretic should be administered. Acetaminophen is safe to administer every four to six hours, even in infancy. Aspirin and other NSAIDs should not be administered during pregnancy. Aspirin should be avoided in children under 12 years of age because of the risk of Reye syndrome, and NSAIDs should be avoided in infants younger than 6 months of age. Long-term or excessive use of acetaminophen should be avoided since it can cause liver failure, while long-term or excessive use of ibuprofen should be avoided since it can cause kidney injury. In cases of pediatric or maternal fever, it is best to contact the healthcare provider to determine the best antipyretic to alleviate symptoms (see Table 15.6).

Stages of Fever

A fever naturally passes through stages as the cause of the infection is eliminated. These stages are the onset, duration, and resolution. The onset of a fever occurs when a temperature of 100°F (37.8°C) is attained. The onset can occur suddenly or gradually depending on the infectious agent. The typical duration of a fever is a few days and is followed by its resolution. During the fever, antipyretic medications may be administered but do not always eliminate the fever. The medications are working if they lower the fever and increase comfort.

Types of Thermometers

Thermometers are instruments that measure temperature. A variety of thermometer styles, including both noninvasive and invasive, are available. Glass thermometers, which contain mercury, were one of the first tools to measure temperature. These types of thermometers are no longer in use because of the danger posed by both the glass housing and the toxic element mercury. The most popular thermometers in homes and healthcare settings are digital, providing a near automatic result on a digital screen. A variety of digital thermometer types are available, for various routes, such as oral, rectal, tympanic, and axillary. The COVID-19 pandemic also played a role in the advent of newer thermometer technology due to the need to assess an individual's temperature rapidly and accurately. One of the more popular thermometers introduced during this time was the no-contact thermal scan thermometers. The type of thermometer used is dependent on the individual and the situation.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Vital Signs: Temperature with Digital Thermometer

See the competency checklist for Vital Signs: Temperature with Digital Thermometer. You can find the checklists on

the Student resources tab of your book page on openstax.org.

Oral

The oral thermometer is the most common type used to measure temperature and yields an average normal result of 98.6°F (37°C). Historically, the oral thermometer was a glass mercury thermometer, but since these were found to be dangerous, they are no longer in use. Currently, oral thermometers are digital, providing a reading within seconds of their use. These thermometers measures temperature through contact with the sublingual region, under the tongue (Figure 15.18).

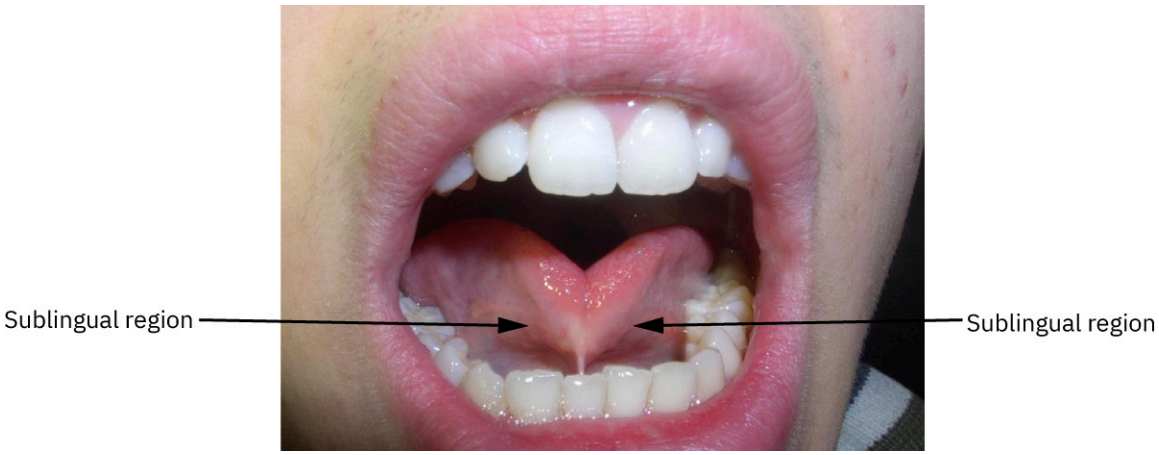

FIGURE 15.18 The sublingual region is under the tongue on either side of the frenulum. (credit: Klaus D. Peter/Wikimedia Commons, CC BY 3.0 DE)

Although the oral thermometer is the most widely used, it does have some limitations. To be able to use the oral route, the patient must be able to understand and follow directions. If they cannot hold it in place, an inaccurate reading will be obtained. Most children will be able to begin using this route around the age of 5 years. Food and drink consumption and smoking can also lead to inaccurate results. Waiting twenty-five minutes after drinking a hot or cold beverage and waiting five minutes after smoking or chewing gum is best practice. Patients who breathe through their mouths have also been found to have lower oral temperatures. Oral thermometers should also be avoided in individuals with oral trauma. Figure 15.19 shows an oral thermometer.

FIGURE 15.19 An oral thermometer must be placed sublingually in order to obtain an accurate reading. Using disposable probe covers helps reduce the transmission of bacteria. (credit: "Oral thermometer" by Jennifer L. Lapum; Margaret Verkuyl; Wendy Garcia; Oona St-Amant; and Andy Tan, CC BY 4.0)

Rectal

The rectal thermometer is considered the gold standard for infants (less than 1 year old) (Johns Hopkins Medicine, 2023). It is the most accurate but also the most invasive type of thermometer. For this reason, it is generally only used for infants and in critical situations. Also, a rectal temperature would be contraindicated with anorectal surgeries and procedures and for those with a low red blood cell count because of the risk of bleeding for those patients. The average rectal reading is approximately 0.5°F (0.3°C) to 1°F (0.6°C) higher than an oral reading. Because of its mode of insertion, into the rectum, the rectal thermometer is denoted by a red color and is only meant to be used rectally (Figure 15.20).

FIGURE 15.20 The red indicator on a digital rectal thermometer alerts the nurse that it is for obtaining rectal temperatures only. (credit: "Rectal thermometer" by Jennifer L. Lapum; Margaret Verkuyl; Wendy Garcia; Oona St-Amant; and Andy Tan, CC BY 4.0)

LIFE-STAGE CONTEXT

Thermometers for the Pediatric Population

A wide variety of thermometers are commonly available on pediatric units. The reason for this variety is that the pediatric unit often cares for neonates through adolescents, requiring different types of thermometers. For infants through the age of 5 years, the axillary thermometer is often the preferred method of obtaining a temperature. If the reading is considerably low or high in an infant or toddler, a rectal thermometer may be used to verify the results. Most older preschoolers through adolescents are able to use the oral thermometer properly, making it the preferred method in this age group. For those children who are developmentally delayed or unable to follow directions, the axillary thermometer is used.

Another type of thermometer, the temporal thermometer, is becoming readily available on pediatric units because of its minimally invasive nature (Figure 15.21). Using the temporal thermometer, a nurse can obtain a temperature on a sleeping child without disrupting sleep. The temporal thermometer could be used on children older than 6 months old.

FIGURE 15.21 A temporal thermometer obtains the temperature by an infrared reading across the forehead. (credit: Air Force Medical Service, Public Domain)

Axillary

Obtaining an axillary temperature is minimally invasive since it only requires contact with the skin of the axilla region under the arm, but its results are generally 1°F (0.6°C) lower than the oral route. Because it is minimally invasive, it is the preferred route of obtaining temperature in young children and those who are unable to follow directions.

Tympanic

The tympanic thermometer obtains a temperature through a probe inserted in the ear (Figure 15.22), and its results are slightly higher than an oral reading because of its proximity to an artery that feeds the hypothalamus. Although it is generally easy to obtain and minimally invasive, it should not be done in those patients with a suspected or known ear infection or facial or ear trauma.

FIGURE 15.22 A tympanic thermometer. Note the disposable probe cover over the probe. (credit: "Tympanic thermometer" by Jennifer L. Lapum; Margaret Verkuyl; Wendy Garcia; Oona St-Amant; and Andy Tan, CC BY 4.0)

Factors Affecting Temperature

As previously mentioned, internal temperature regulation is controlled by the hypothalamus. Factors affecting the ability of the hypothalamus to regulate temperature include age, gender, exercise, emotions, and even the time of day. Neonates, particularly preterm infants, have a difficult time maintaining temperature because of their immaturity and inability to shiver. Brown fat, which is developed during the last months of gestation, aids in neonate thermoregulation. Consequently, lack of brown fat in preterm babies compromises their ability to regulate their temperature. A low temperature in these age extremes may be more serious than a high temperature.

Body temperature is not statistically different in men and women, even though females tend to feel cooler (Parkinson et al., 2021). This difference may be attributed to a slightly more rapid metabolism and increased muscle mass in men. Females also experience temperature changes in relation to their menstrual cycle. For instance, the female's body temperature drops just prior to ovulation and then increases following ovulation. Increased metabolic activity, such as exercising, has been found to increase body temperature. The human body's circadian rhythm also affects temperature as the day progresses, with a peak between 10 a.m. and 1 p.m. Times of high metabolic activity increase temperature because of the increase in chemical reactions producing heat within the body (National Institute of General Medical Sciences, 2022). Interestingly, feelings of excitement or love can also increase temperature (Escobar, 2021).

LIFE-STAGE CONTEXT

The Danger of Low Temperature

When the body system is assaulted by an infectious agent, the body temperature plummets since all the resources are now targeted on the infection and not on thermoregulation. Because of this, a temperature below 97°F (36.1°C) requires immediate intervention to rule out a life-threatening infection. Very young and very old patients will have consistent temperatures slightly below the "normal range." For example, the range 97.5°F to 98.5°F (36.4°C to 36.9°C) is considered normal for neonates and geriatric patients. However, it is important to remember these age groups react differently to drastic changes in temperature. For drastically high or low temperatures, an infant may become less active to stimuli and not want to eat, while an older adult patient may become confused and disoriented, or even agitated.

Physiological disorders may also cause fevers or the inability to thermoregulate. Certain cancers are known to cause fevers for reasons not fully understood, but because of the high-risk nature of this group, it is always imperative to rule out infectious causes of fever. Autoimmune disorders may also cause fevers through activation of the immune system. A traumatic brain injury can also affect thermoregulation because of damage to the hypothalamus.

Exposure to extreme or prolonged temperature extremes may also affect a person's temperature. Being exposed to

cold temperatures may lead to hypothermia, particularly if it is prolonged or if the person is underdressed or becomes wet. Hyperthermia may develop in the heat, particularly if the person is doing strenuous activity. Heat exhaustion occurs when the body temperature reaches higher than 100°F (38°C) due to the environment. Heat stroke occurs when the body temperature is greater than 104°F (40°C). Signs and symptoms of the progression to heat stroke are dry and hot skin with no sweating, high heart rate, and confusion or delirium. It can progress rapidly to convulsions and coma and may be fatal.

A temperature reading may also be inaccurate due to incorrect technique. If an abnormal result is obtained, it is best practice to repeat the reading. It may be necessary to check the accuracy of the results using a rectal thermometer if the condition warrants. For oral thermometers, verify that the patient has not eaten, drank, or smoked recently and that the thermometer is in the correct location in the mouth. For rectal thermometers, verify that the tip is inserted enough and that an excessive amount of lubricant was not used. For axillary thermometers, double-check that the tip of the probe is deep within the axillary region. For tympanic thermometers, straightening the ear canal could help obtain a more accurate reading.

15.5 Heart Rate

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe anatomical locations for obtaining the pulse
- Describe the different pulse characteristics
- Identify factors affecting pulse rates

Palpating the pulse is another aspect of obtaining vital signs. Blood flow, which is caused by the beating heart, can be detected where arteries occur close to the surface of the skin. The pulse, along with breathing, is one of the first vital signs assessed in emergency situations because it demonstrates cardiac functioning. When monitored routinely, the pulse provides a baseline for the perfusion of the body and alerts the practitioner to any changes in this baseline. Palpation of the peripheral pulses, those arteries farthest away from the heart, provide the nurse with a wealth of information, such as the heart rate, rhythm, and strength.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Vital Signs: Pulse and Respiratory Rate

See the competency checklist for Vital Signs: Pulse and Respiratory Rate. You can find the checklists on the Student resources tab of your book page on openstax.org.

Pulse Locations

Pulse locations are anatomical places on the body where the pulse should be readily palpable because of the artery's proximity to the surface of the skin (Figure 15.23). The most frequent locations for detecting pulses are over the radial, temporal, and carotid arteries.

The most common pulse location is the radial pulse. This pulse is found on the distal lateral forearm. The radial pulse is the preferred site to obtain a pulse for routine vital signs.

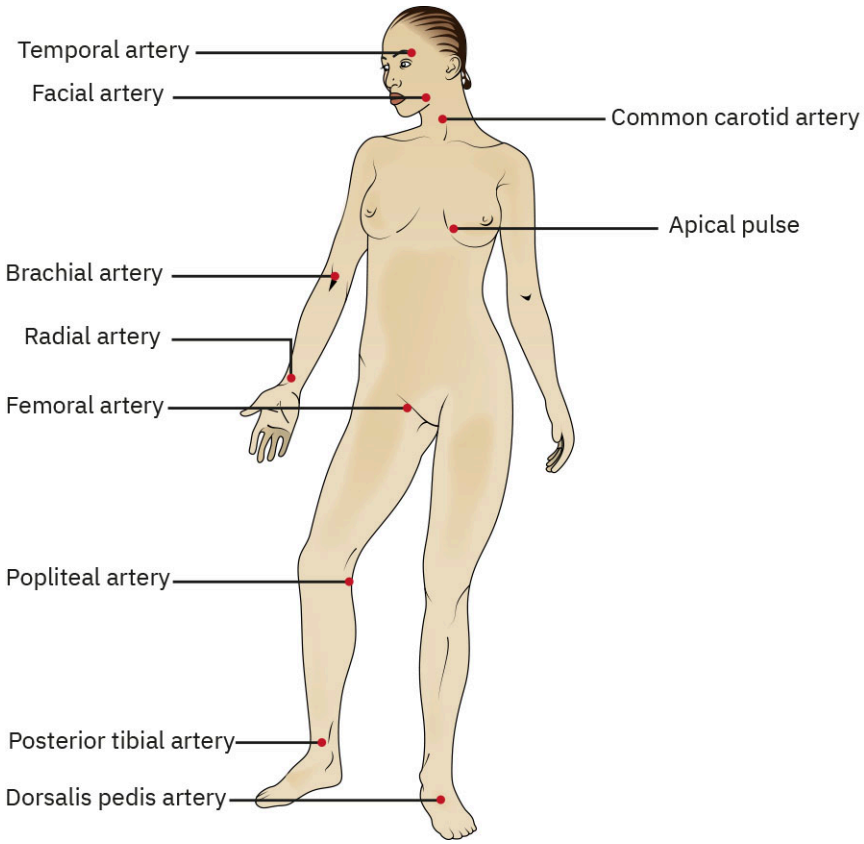

FIGURE 15.23 The pulse is most readily measured at the radial artery but can be measured at any of the pulse points shown. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

The temporal pulse site is located on either side of the forehead. The carotid pulse is located on the anterior neck on both sides of the trachea. This is the location of large arteries that branch off the aorta and are the main blood supply to the brain. When a nurse must check the carotid pulse, only one side should be assessed at a time to not restrict blood flow to the brain. This pulse location, due to its size, is often checked in emergency situations to verify the presence or absence of a pulse.

The apical pulse is auscultated directly using a stethoscope. It is located at the fifth intercostal space, midclavicular line on the anterior chest wall. The apical pulse is counted for one full minute when obtaining routine vital signs. Certain populations need the apical pulse auscultated rather than palpating the peripheral pulse. For example, the heart rate should be auscultated in patients receiving digoxin, a medication that affects the heart rate and contraction, and those with an irregular rate or rhythm. As a nurse, if the peripheral pulse requires further investigation, for example, too weak to be felt or too fast to be counted, listening to the apical pulse is a good way to validate results.

The brachial pulse is found in the inner antecubital space and is used when obtaining blood pressure. The stethoscope is placed over this artery to listen to blood flow in the arteries. In infants, the brachial pulse is felt in the inner upper arm and is the preferred upper extremity peripheral pulse site in this age group. It is used in emergency situations to determine the presence or absence of a pulse in infants since the carotid pulse is difficult to quickly locate.

The femoral pulse is found in the groin. The femoral artery is a large artery that provides blood flow to the lower extremities. This femoral pulse is the preferred lower extremity pulse site in infants.

There are several other pulse locations in the lower extremities. One such pulse site is the popliteal pulse, found behind the knee. Other lower extremity pulses are the posterior tibial pulse, located behind the inner ankle, and the dorsalis pedis pulse, commonly called the pedal pulse, which is located on the dorsal aspect of the foot. The dorsalis pedis pulse is the preferred lower extremity peripheral pulse site in adults and children.

When obtaining routine vital signs on an adult, the nurse should assess the radial pulse. However, sometimes this

location might not be the optimal pulse location. The radial pulse is not always available to be assessed. For example, the patient may have an arterial line inserted or a cast or bandage may be covering the site. Amputation may also have occurred. In cases where the radial pulse is inaccessible, the nurse should auscultate to obtain the apical pulse. The apical pulse should be listened to for a full minute to determine the heart rate, and the brachial and femoral pulses should be palpated to assess peripheral perfusion. Palpation of the pulse is a direct representation of blood volume and flow. A weak, thready pulse may be due to reduced cardiac blood flow such as with dehydration or heart disease.

Pulse Characteristics

When obtaining the pulse, or heart rate, the nurse is also assessing characteristics such as rhythm, depth, and quality. Characteristics of the pulse provide information about the predictability and efficiency of the heart and the quality of the blood vessels. For instance, the heart may be strong and healthy, but if the blood vessels are occluded, the pulse will feel weak or even absent. The nurse needs to note the rhythm, depth, and quality of the pulse to ensure the health of the cardiovascular system.

Rate

The pulse rate, measured in beats per minute, is obtained to ensure the heart is beating adequately. The normal range for an adult pulse rate is 60 to 100 beats per minute. Because the range is wide (Table 15.7), the nurse should also be familiar with the patient's trends, if available. In general, pulse rates for females are slightly higher than for males, and infants and children have a pulse rate that is higher than the adult range.

Age	Heart Rate (beats per minute)
Birth to 4 weeks	130 to 190
1 to 3 months	125 to 185
3 to 6 months	110 to 165
6 to 12 months	105 to 160
1 to 3 years	100 to 155
3 to 5 years	70 to 120
5 to 8 years	60 to 110
8 to 12 years	55 to 100
Adolescents	50 to 100
Adults	60 to 100

TABLE 15.7 Heart Rates by Age

Adolescents and athletes tend to have a slower resting heart rate, to rates as slow as 40 to 50 beats per minute. This is because the strength and force of their heart contraction is greater than for most of the population, which produces a greater stroke volume. The **stroke volume (SV)** represents the amount of blood pumped by the left ventricle with each contraction. Heart rate and stroke volume determine cardiac output. The **cardiac output** is the total amount of blood ejected by the heart into circulation in one minute, measured in liters. The formula for cardiac output is CO (cardiac output) = SV (stroke volume) × HR (heart rate). If the stroke volume is significantly increased, the heart rate can decrease as the same cardiac output is achieved. Stroke volume and cardiac output are inversely related.

A pulse rate slower than 60 beats per minute is known as **bradycardia**, whereas a pulse rate faster than 100 beats

per minute is referred to as **tachycardia**. If the heart fails to contract and produce a pulse, it is known as **asystole**.

Rhythm

When the pulse is being assessed, the nurse should also take note of the regularity of the pulse, also known as its rhythm. A regular rhythm is normal with predictable beats, whereas an irregular rhythm may indicate the presence of cardiac anomalies such as atrial fibrillation.

An abnormal heart rate and rhythm is known as **arrhythmia** (also called *dysrhythmia*). Bradycardia, tachycardia, atrial fibrillation, and ventricular fibrillation are some of the most common arrhythmias. Fibrillation occurs when a chamber of the heart, either the atrium or ventricle, is unable to contract. Instead of contracting completely, it quivers. In ventricular fibrillation, no pulse or contraction of the heart is present, resulting in decreased stroke volume and decreased cardiac output, which requires resuscitation.

Volume

The strength of the pulse provides qualitative information on the volume of circulating blood volume. A healthy pulse is a strong pulse. However, a very strong pulse is described as *bounding*. Bounding pulses may occur in cases of right-sided heart failure because blood becomes backed up in the peripheral circulation. In contrast to very strong pulses, weak pulses are caused by a variety of conditions, including loss of blood volume, peripheral vascular disease, and left-sided heart failure.

Factors Affecting Pulse Rates

Normal and healthy fluctuations can occur, and they affect pulse rate. Exercise, particularly aerobics, increases pulse rate. Sleep, conversely, decreases the pulse. Emotions also affect the heart rate. Intense fear and anxiety increase the pulse rate, while relaxation lowers it.

REAL RN STORIES

Emotions Lead to a Trip to the Emergency Department

Nurse: Cielita, RN
Clinical setting: Pediatric intensive care unit
Years in practice: 15
Facility location: Florida

I was once caring for a young boy who suffered cardiac arrest, was resuscitated, and was admitted to the pediatric intensive care unit in a coma. The boy's father was so distraught, and the mother encouraged him to go to a walk-in clinic to get some medications for his anxiety. He went to the clinic, but when they checked his heart rate, they ordered an electrocardiogram (ECG) which came back irregular. An ambulance was called to bring him over to the nearest emergency department. At the emergency department, his heart rate was extremely elevated, but once he heard his son was improving, his heart rate normalized. After multiple cardiac tests, no other cause was determined for this brief abnormality besides his emotions.

Pulse rate abnormalities also occur because of physical conditions. Conditions that increase metabolism, such as a fever and hyperthyroidism, will also increase the pulse rate. A lack of oxygen will also increase pulse rate. A lack of oxygen can occur as a result of a variety of pulmonary complications. Without enough oxygen, body tissues are unable to be perfused, or receive the oxygen needed to function. The body then feeds this information back to the brain, which signals the heart to then attempt to resolve by increasing the heart rate. When circulating blood volume is decreased, heart rate will also increase to compensate for the lack of perfusion.

Cardiac abnormalities will also affect pulse rate. Structural problems with the heart may lead to an increased pulse rate since the efficacy of the heart contraction is generally weakened. Heart failure, which may result from structural cardiac anomalies or lifestyle, may also increase heart rate. The heart is unable to contract effectively, which, in turn, causes the heart rate to compensate to aid in maintaining cardiac output. Electrical abnormalities in the heart will lead to a host of cardiac arrythmias, which affect not only pulse rate but also the rhythm.

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 2

Refer back to Unfolding Case Study #3: Part 1 to review the patient data.

Assessment	**1200:** **Neurological:** Alert and oriented ×4, GCS 15 **HEENT (head, eyes, ears, nose, and throat):** Within normal limits **Respiratory:** Accessory muscle use, tripod positioning, crackles in lung bases, fingernail clubbing noted **Cardiovascular:** Weak, thready pulse. 1+ pitting edema of bilateral lower extremities **Abdominal:** Within normal limits **Musculoskeletal:** 4/5 muscle strength of right arm, all other extremities 5/5 **Integumentary:** Skin pale but dry and intact
Provider's Orders	**1215:** Continuous ECG monitoring Start home medications Vital signs Q4 hours Admit to medical-surgical unit for observation

3. Prioritize hypotheses: Based on the findings presented, the nurse hypothesizes that the patient may be experiencing heart failure exacerbation. As the nurse is preparing to obtain vital signs, what abnormalities would the nurse expect to find if the hypothesis of heart failure is correct?
4. Generate solutions: The nurse prepares to check the patient's vital signs, including pulse. Where on the body would the nurse check the pulse, and what characteristics of the pulse would the nurse anticipate, based on the patient's condition?

15.6 Respiration

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Distinguish variations in respirations by age groups
- Describe characteristics of respirations
- Identify factors affecting respiration rates

Obtaining respirations, or breathing pattern, is another aspect of checking vital signs. One respiration is complete inspiration and exhalation. Inspiration is the intake of air into the lungs where gas exchange occurs. During inspiration, the diaphragm relaxes, enlarging the lung fields and lowering the pressure within the thoracic cavity to allow for an increase in lung volume. Exhalation is the removal of air from the lungs following gas exchange. During exhalation, the diaphragm contracts, reducing the lung fields and increasing the pressure within the thoracic cavity. The process of gas exchange is the absorption of oxygen from the inhaled air into the blood and the removal of carbon dioxide from the blood. The oxygen and carbon dioxide saturation in the blood signals to the brain to increase, decrease, or maintain the respiratory rate. Obtaining the respiratory rate verifies that the patient is breathing and not in respiratory distress while also ensuring the rhythmic exchange of oxygen and carbon dioxide. For routine vital sign assessment, the nurse obtains the respiratory rate by observing the rise and fall of the chest immediately following the pulse check.

Variation of Respirations by Age

For adults, the respiratory rate is 12 to 20 breaths per minute, but for infants and children, their normal rate is increased. A newborn, for example, has an expected respiratory rate of 30 to 60 breaths per minute. Table 15.8 summarizes the normal ranges of respiratory rates across the life span.

Age	Respiratory Rate
Infant	30 to 60 breaths per minute
Toddler	20 to 30 breaths per minute
Preschooler	20 to 25 breaths per minute
School age	14 to 22 breaths per minute
Adolescent	12 to 18 breaths per minute
Adult	12 to 20 breaths per minute

TABLE 15.8 Respiratory Rates across the Life Span

LIFE-STAGE CONTEXT

The Rationale for Higher Heart and Respiratory Rate in the Pediatric Population

Infants' and children's respiratory and heart rates are normally faster than those of adolescents and adults. The fastest ranges are in neonates. As humans age, respiratory rates gradually shift with age to an adult range sometime in late childhood or early adolescence. One reason for this normal increase is that infants and children have a faster metabolism, which is needed for their rapid growth and development. Another reason for this increase is the smaller size of the heart and lungs. To maintain adequate perfusion and oxygenation, the heart and lungs will have to work faster since they are handling a smaller volume than adults (Cleveland Clinic, 2023).

Oxygen Saturation

The efficiency of the respiratory system is assessed not only through obtaining the respiratory rate but also by assessing the oxygen saturation of the blood, abbreviated as SpO_2. The respiratory system's function is to promote gas exchange and oxygenate the blood. To assess if blood, specifically hemoglobin, is being adequately oxygenated, a pulse oximeter is used during obtainment of vital signs. The normal range for oxygen saturation (SpO_2) at all ages is 96 to 100 percent, meaning that the hemoglobin is thoroughly saturated. At times, a patient's expected oxygen saturation trends may vary from this range. Examples include those with structural heart abnormalities and those with COPD. COPD causes a normal oxygen saturation that ranges from 88 to 93 percent.

Pulse Oximeter Readings

The pulse oximeter assesses the oxygen saturation of hemoglobin by placing a probe most commonly over a finger. The pulse oximeter may be ordered as continuous monitoring with parameters set or scheduled to be obtained with vital signs (Figure 15.24). In infants and young toddlers, the continuous probe may be inserted on the big toe to avoid patient interference with the monitor. In neonates, the probe may be placed around the baby's foot. This type of probe may be attached to an infant's foot or toe as well.

FIGURE 15.24 In continuous monitoring, the probe is attached to the patient's finger with tape. (credit: "Pulse oximeter with sensor taped around finger" by Ryerson University, CC BY 4.0)

REAL RN STORIES

Standard Supply Room Equipment: Nail Polish Remover

Name: Jessica, RN
Clinical setting: Emergency department
Years in practice: 14
Facility location: Wilmington, North Carolina

As a new nurse, I remember trying to find supplies in the supply room. Whenever I would go in there to hunt for something, it would seem to take forever to find it. One time I needed to restock alcohol prep pads and grabbed a handful of individually packaged pads. It was only when I went to the room that I realized I grabbed nail polish remover instead of alcohol prep pads. Imagine my embarrassment pulling out nail polish remover to try to clean my patient's IV site. After that incident, I asked an experienced nurse why we kept nail polish remover in the unit supply room. It just did not make sense. The nurse told me that nail polish can hinder the pulse oximeter's reading because it prevents the light from analyzing the red blood cells. From my silly mistake, I learned that nail polish remover is actually an important supply kept on the units, and I always keep a few with me just in case the pulse oximeter cannot pick up the patient's oxygen saturation through painted fingernails.

Some pulse oximeters show the wavelength of the pulse along with the pulse rate and oxygen saturation (Figure 15.25). This wavelength can provide more information regarding the accuracy of the reading. A rhythmic wavelength that mimics the palpated pulse should be displayed on the screen. Artifact, an abnormal, chaotic wavelength, is most likely due to movement or improper placement of the probe.

FIGURE 15.25 Some pulse oximeters display the regular wavelength, in addition to the oxygen saturation (SpO_2) and pulse rate. (credit: U.S. Agency for International Development/Flickr, CC0)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Pulse Oximetry

See the competency checklist for Pulse Oximetry. You can find the checklists on the Student resources tab of your book page on openstax.org.

Respiration Characteristics

When obtaining the respiratory rate, the nurse should observe the rise and fall of the patient's chest. When observation alone is insufficient, the nurse may need to use the stethoscope to auscultate the respiratory rate. The stethoscope should remain in one place over the patient's lung field. When assessing the respirations, the nurse needs to take note of the breaths per minute, also known as the respiratory rate, rhythm, and depth of respiration. Unlabored breathing should be audibly quiet.

LINK TO LEARNING

A review of the procedures for obtaining an accurate respiratory rate (https://openstax.org/r/77resprate) is presented in this video.

Rate

A nurse first checks the respirations for the breaths per minute. This is done after the nurse obtains the heart rate. Once the heart rate is obtained, the nurse does not remove their fingertips from the pulse site but simply shifts their gaze to the rise and fall of the chest. There is no need to let the patient know their respiratory rate is being obtained because the knowledge could cause the patient to unknowingly alter their breathing pattern. The normal adult respiratory rate is 12 to 20 breaths per minute. When the respiratory rate exceeds 20 breaths per minute, **tachypnea** occurs. It can occur due to physical changes or emotional ones, such as anxiety and fear. When the rate

is below 12 breaths per minute, **bradypnea** occurs. A lower-than-normal respiratory rate is also called **respiratory depression**, a side effect of anesthetics and opioids.

Rhythm

While the nurse is counting the rate, it is important to also note the regularity of the respirations. A healthy pattern is a regular pattern of respiration, whereas an irregular pattern may warrant the need for further investigation. Irregular breathing could also occur when the patient is aware that the nurse is counting their respirations. Respirations are both an involuntary and voluntary action, meaning that an individual may purposefully breathe faster or slower, or sigh, but will also continue to breathe without consciously thinking about it. The heart beating, on the other hand, is strictly an involuntary action controlled by the brainstem.

A nurse may encounter several irregular respiratory rhythms among patients. Shallow breathing occurs with hyperventilation, pain, and pneumonia. Tachypnea occurs in times of hypoxia and respiratory distress or emotional distress. A more rapid and deep pattern or rhythm of breathing experienced primarily with diabetic ketoacidosis is called **Kussmaul respiration**. Another abnormal rhythm is **Cheyne-Stokes respiration**. It is characterized by periods of rapid and shallow breathing followed by a period of **apnea**, a complete cessation in breathing. Agonal breathing occurs at the end of life and mimics Cheyne-Stokes respiration. Cheyne-Stokes respiration is a mixture of complete apnea and respiratory failure.

Depth

While observing the rate and rhythm of the respirations, the nurse should also note the depth of the breaths. That is, note if the breathing is shallow or deep. A healthy breathing depth is neither shallow nor deep but enough to cause the chest to rise and fall. Breathing that is too shallow is often seen postoperatively with chest or abdominal surgeries because pain hinders an adequate breath. If this continues, **atelectasis**, collapsing of the alveoli, can develop and progress to larger portions of the lungs. In contrast, deep breathing, a sign of respiratory distress, is seen when the body is attempting to increase the oxygenation of the blood or blow off excess carbon dioxide.

Factors Affecting Respiration Rates

The respiration rate is affected by acid-base imbalances, pulmonary complications, neurological issues, and increased metabolism. Since carbon dioxide is an acid, an acid-base imbalance will affect a patient's breathing pattern. The two main categories of an acid-base imbalance are acidosis, the excess of acid or loss of base, and alkalosis, the loss of acid or excess of base. When the body enters acidosis because of nonpulmonary issues, the pulmonary system attempts to compensate by expelling its acid, carbon dioxide. This is accomplished through tachypnea and hyperventilation. Conversely, when alkalosis is present due to nonpulmonary issues, the lungs compensate by holding onto its acid through hypoventilation and bradypnea.

Pulmonary complications are a major cause of respiratory abnormalities. When a patient is in respiratory distress, tachypnea and **dyspnea**, difficulty breathing, are the first signs exhibited. Another sign of respiratory distress is **accessory muscle use**, which includes using voluntary muscles to aid in the process of breathing. Pulling of the neck muscles and nasal flaring are just two examples of this. Left-sided heart failure also affects the pulmonary system by causing a backup of blood into the lungs. Because of the buildup of blood, the patient will have a difficult time breathing and may be unable to lay down, known as orthopnea.

Concerns in the central nervous system affect respirations since the **medulla** is the respiratory control center. Any damage that affects the medulla will affect respiration. Severing of the spinal cord at or above C4 will cause paralysis of the diaphragm and the inability to breathe. After a seizure, chaotic firing in the brain, the person will enter a postictal state (altered level of consciousness after seizure activity), which may cause bradypnea. Opioids and anesthetics are known to depress the respiratory system as well. This is why it is vital that a nurse obtains the respiratory rate prior to administration and monitor it closely while a patient is receiving medications known to cause respiratory depression.

Conditions that increase metabolism also increase the respiratory rate. These include fever and hyperthyroidism. Infants and children also tend to have a faster metabolic rate than adults, which causes a faster normal respiratory rate in these young patients.

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 3

Refer to Unfolding Case Study #3: Part 2 to review the patient data.

Flow Chart	**1230:** Blood pressure: 142/78 Heart rate: 112 beats per minute Respiratory rate: 29 breaths per minute Temperature: 99.6°F (37.5°C) Oxygen saturation: 82 percent on room air Pain: 3/10

5. Take action: Based on the patient's vital signs, what interventions should the nurse implement immediately?
6. Evaluate outcomes: The nurse contacts the provider about the patient's vital signs and is told to put the patient on 2 L oxygen via nasal cannula. What assessment findings would indicate that this intervention was successful?

15.7 Blood Pressure

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe correlation in blood pressure readings with severity of hypertension
- Discuss the importance of blood pressure cuff and size
- Identify factors that affect blood pressure

Blood pressure is the pressure exerted by the blood on arterial walls and must be measured to ensure the pressure is adequate to perfuse the body and not too great to rupture the blood vessels. It consists of two numbers, a higher systolic and lower diastolic, and is reported as a fraction with the systolic on top and the diastolic on the bottom. Systole is the pressure of blood during contraction of the left ventricle. Diastole is the pressure of the blood when the ventricles are at rest and filling.

Variations in Blood Pressure

The normal adult blood pressure ranges between 90 to 120 systolic and 60 to 80 diastolic, but it can vary due to medical conditions and age. An elevated blood pressure is known as **hypertension** and a lowered one is called **hypotension**. Either of these conditions can lead to serious health consequences. Hypertension increases the pressure placed on the arterial walls leading to complications such as hemorrhagic stroke but also increases the risk of a myriad of health conditions if it occurs with other comorbidities, particularly myocardial infarction, heart failure, cerebrovascular accident, and end-stage renal disease. Hypotension also presents various dangers. Hypotension means that blood is not being circulated sufficiently, which can lead to ischemia, anoxic brain injury, and even death. Hypotension is a hallmark characteristic of shock, a life-threatening condition that develops from multiple medical causes.

The presence of hypertension is considered a modifiable risk factor for cardiac and neurological conditions. Because it is often due to lifestyle choices, blood pressure is monitored annually and then more frequently if hypertension begins to develop. As a patient's trends begin to increase outside of normal ranges, blood pressure is further categorized based on its risk to the individual and the recommended treatments (Table 15.9). An elevated blood pressure requires more frequent monitoring because the risk of hypertension is present. Hypertension is classified as either stage one or the more severe stage two. These classifications can help guide the plan of care for the patient.

Category	Blood Pressure Reading
Normal	90 to 119/60 to 80
Elevated	120 to 129 systolic and ≤80 diastolic
Stage I hypertension	130 to 139 systolic or 80 to 89 diastolic
Stage II hypertension	≥140 systolic or ≥90 diastolic

TABLE 15.9 Categories of Hypertension

Blood Pressure Cuff and Size

Blood pressure cuffs are available in a variety of sizes and are meant to wrap around the upper arm. The nurse is responsible for obtaining a proper size cuff for the patient (Figure 15.26). Within the cuff is the inflatable bladder, which, when inflated, impedes the blood flow through the brachial artery. The edges of the cuff will encircle the upper arm and be secured with Velcro to ensure that the cuff does not pop off during inflation of the bladder.

FIGURE 15.26 Blood pressure cuffs come in many sizes to ensure the proper fit for patients of all sizes. Shown in the top row, from left to right, are sizes bariatric, adult large, and adult; in the bottom row, from left to right, are sizes child, infant, and neonate. (credit: "Sizes of blood pressure cuffs" by Chippewa Valley Technical College, CC BY 4.0)

The first step is selecting which arm to use, this can be patient preference or the need to avoid the arm with IVs, lymphedema, fistulas, and so on. The width of the cuff should cover approximately 80 percent of the upper arm from shoulder to elbow, and the bladder within the cuff should encircle about 40 percent of the arm. An improper blood pressure cuff size leads to an inaccurate reading. If a blood pressure cuff is too large, the reading will be lower. If it is too small, the reading will be higher. At times, hypertension has been missed by medical personnel simply due to improper equipment.

The individual's position can also affect the blood pressure reading. It is important for the nurse to instruct the patient to remain seated with the hand at the level of the heart and feet flat on the floor. Simply crossing the legs or ankles can lead to an inaccurate reading. It is also important to instruct the patient not to talk; to avoid caffeine and

smoking thirty minutes prior, if possible; and to try to sit quietly for five minutes before, if possible.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Vital Signs: Blood Pressure

See the competency checklist for Vital Signs: Blood Pressure. You can find the checklists on the Student resources tab of your book page on openstax.org.

Korotkoff Sounds

To place the cuff, the nurse will align the cuff on the patient's arm, aligning the artery with the artery position indicator label on the cuff. The valve of the inflation bulb should be fully closed, then the nurse will place the diaphragm of the stethoscope over the brachial artery and inflate the cuff by squeezing the bulb. The gauge will inform the nurse of the pressure as the cuff inflates. Once the cuff is inflated to pressures greater than normal ranges and those indicated by the patient's blood pressure trends, the nurse will begin to slowly deflate the bladder while carefully listening for the return of the pulse. This is done by turning the knob on the valve counterclockwise approximately 2 mm/s while listening and watching the pressure indicated on the gauge. The pulsating, tapping sound heard with a stethoscope as blood flows through the brachial artery is known as a **Korotkoff sound**. The first Korotkoff sound is the systolic blood pressure reading, and the last Korotkoff sound is the diastolic reading. Once the diastolic number is obtained and there are no more Korotkoff sounds heard, the bladder can be quickly deflated and the cuff removed. Remember that if the blood pressure does not align with the patient's previous trends, the nurse should recheck in the other arm, recheck with a manual cuff if the reading was taken using an electronic machine, or let the patient rest for five minutes and recheck.

LINK TO LEARNING

A demonstration of what to listen for when listening for the Korotkoff sounds (https://openstax.org/r/77korotkoff) is presented in this video.

Pulse Pressure

The difference between the systolic and diastolic blood pressure is the **pulse pressure**, which should normally be about 40 mm Hg. The pulse pressure is directly related to the blood volume, meaning that a decrease in blood volume will cause a decrease in pulse pressure. The pulse pressure is indirectly related to arterial compliance, meaning that inelastic arteries will have a wider pulse pressure. Abnormal pulse pressures are defined as either narrowed or low or widened or high. A **narrowed pulse pressure** is defined as a pulse pressure less than 25 percent of the systolic blood pressure (i.e., 110/85). A **widened pulse pressure** is defined as more than 100 mm Hg (i.e., 174/69). In athletes or those with increased muscle mass, a widened pulse pressure may be normal, and as people age, the pulse pressure continues to widen due to the loss of arterial compliance. Widened pulse pressure is a sign of other health conditions such as aortic valve abnormalities (regurgitation or sclerosis), hyperthyroidism, arteriosclerosis, and iron deficiency anemia. In contrast, narrow pulse pressure is present when the ventricles are unable to fully contract. These conditions include heart failure, cardiac tamponade, and aortic stenosis. Blood loss, dysautonomia, and postural orthostatic tachycardia syndrome also cause a narrow pulse pressure.

The risk for heart disease and atrial fibrillation increases in individuals with a widened pulse pressure. Even a 10 mm Hg rise in the pulse pressure can increase the risk of cardiovascular disease by 20 percent. Because of this risk, the pulse pressure should be monitored and kept in a normal range. The only proven way to maintain a healthy pulse pressure is by aerobic exercises, as these increase the arterial elasticity (Homan, 2022).

Auscultatory Gap

When a manual blood pressure is obtained, the nurse listens carefully for the Korotkoff sounds, noting both the origin and the disappearance of these sounds to record as the systolic and diastolic blood pressure measurements. Between the origin and the disappearance of the Korotkoff sounds is the **auscultatory gap**, a brief absence in the sounds. The auscultatory gap may be confused with the diastolic blood pressure if the nurse does not continue to

listen for a few more seconds, leading to an inaccurate measurement. The auscultatory gap can also be missed in individuals with elevated blood pressures if the cuff pressure is not pumped high enough (Rehman, 2022).

LINK TO LEARNING

Test your ability to obtain manual blood pressure (https://openstax.org/r/77korotkoff) using this interactive tool from PurposeGames.

Factors Affecting Blood Pressure

Blood pressure is determined by the force of heart contractions, the diameter of the blood vessels, and the amount of circulating blood. If any of these factors are abnormal, blood pressure will be abnormal.

The force of heart contractions will determine the force that blood exerts on the arterial walls. During exercise, the heart will strongly contract, increasing the blood pressure temporarily during the activity. When the heart contractions are weak, blood pressure drops. If the heart is unable to contract and pump blood through the vasculature, it is known as cardiogenic shock. A primary cause of this is heart failure.

REAL RN STORIES

High Blood Pressure in the Clinic

Nurse: Sarah, RN
Clinical setting: Outpatient clinic
Years in practice: 5
Facility location: Bedford, New Hampshire

A 35-year-old male comes into the clinic for a routine preventive visit. Because it was the early afternoon, we were not busy and were able to call him back as soon as he arrived. The first thing I do is have him take a seat and apply the blood pressure cuff while I ask him some general questions. To our surprise, the blood pressure began alarming at 144/70. I checked his results from the previous year and noticed normal readings. I verified that his ankles were uncrossed, and the cuff was in the right position. He asked me if that was normal. I asked if he was nervous since white coat syndrome—anxiety in healthcare settings—can temporarily increase blood pressure. He denied any anxiety.

After a recheck with the blood pressure slightly lower but still elevated, we tried to figure out what may have caused it. Perhaps a family history, lifestyle change. Nothing. "I'm running around all the time. I was almost late to this appointment and had to run up the stairs since the elevator wasn't working." Then I realized his blood pressure was elevated because he was running up the stairs to make it to his appointment on time.

The diameter of the blood vessels also affects blood pressure. If the diameter increases, the blood pressure decreases. If the diameter decreases, the blood pressure increases. An increase in the diameter of the blood vessel is called **vasodilation**. A decrease in blood vessel diameter is called **vasoconstriction**. To illustrate this relationship, consider drinking water through a narrow coffee stirrer versus a wider smoothie straw. It takes more effort or pressure to suck the water through the coffee stirrer than it would through the smoothie straw because of the narrow diameter of the stirrer. The same concept applies to blood vessel diameter and blood pressure. Severe vasodilation, with resultant hypotension, occurs in cases of septic and anaphylactic shock and drug overdoses, such as with opioids and cardiac medications. Severe vasoconstriction, leading to life-threatening hypertension, occurs in cases of cocaine overdose. Vasoconstriction also occurs as a compensatory mechanism in cases of extreme blood loss or cold. The fight-or-flight response, also known as the activation of the sympathetic nervous system, triggers vasoconstriction. In emergency situations, explained further in Table 15.10, blood is shunted from the periphery to the heart, lungs, and brain to provide additional stores to the vital organs for the response, known as shock. Shock is fatal if left untreated. The amount of available blood also affects blood pressure. Even if heart contractility and vasculature are healthy, if blood volume decreases, blood pressure will decrease. This is observed in hypovolemic shock, which occurs with hemorrhage or severe dehydration.

Types of Shock	Description	Causes
Cardiogenic	Heart unable to contract efficiently, which decreases the amount of circulating blood	Heart failure, myocardial infarction, arrhythmias, cardiomyopathy, cardiac tamponade
Distributive	Systemic vasodilation	Sepsis, anaphylaxis, burns
Hypovolemic	Loss of blood volume	Hemorrhage, dehydration
Neurogenic	Inability to maintain heart rate and blood pressure	Central nervous system injury (brain or spinal cord)

TABLE 15.10 Types of Shock

CLINICAL JUDGMENT MEASUREMENT MODEL

Analyze Cues: Shock

A 19-year-old female visits the emergency department complaining of dizziness, vaginal pain and discharge, abdominal pain, nausea, and vomiting. She appears diaphoretic. The nurse obtains a set of vital signs.

- Temperature 103.3°F (39.6°C)
- Pulse 134 bpm
- Respiratory rate 28 breaths per minute
- Blood pressure 86/58 mm Hg

A vaginal specimen is obtained to determine the presence of a sexually transmitted infection. The culture is positive for gonorrhea.

Analyzing this information, the decreased blood pressure, increased pulse, and presence of dizziness would lead to a diagnosis of shock.

After obtaining all the data, the nurse contacts the healthcare provider immediately for further orders and may suspect septic shock from untreated gonorrhea.

Lifestyle factors can instigate the development of hypertension. An unhealthy diet and a sedentary lifestyle can lead to atherosclerosis, plaque buildup in the arteries. This plaque in the arteries decreases the diameter and elasticity of the blood vessels leading to hypertension. Obesity itself will increase the risk of hypertension because the distance that the blood must travel is increased. With this increased distance, the heart must work harder, increasing the blood pressure. A healthy diet and exercise can help maintain a healthy blood pressure.

As previously mentioned, an incorrect cuff size or even patient position could alter the reading and yield an inaccurate result.

CULTURAL CONTEXT

Hypertension in Black People

It is well documented that those of certain ethnicity or descent are at an increased risk of hypertension. A multitude of hypotheses exist for why this group suffers disproportionately from this condition, such as genetic factors and lifestyle, but perhaps another explanation is relevant. Could healthcare inequality and social determinants of health, particularly finances and access to health care, affect the development of hypertension among ethnicities such as Black, Asian, and Hispanic? Researchers are beginning to ask this same question. Nurses should be aware of social determinants of health that may affect the timely identification and treatment of hypertension, such as unreliable

transportation or unfavorable and inaccessible office hours. Noting these social determinants of health during the initial assessment can help provide cues into personalized treatment plans. It is the nurse's responsibility to be patient advocates and nurture equality in health care to help alleviate some of the health burdens placed on at-risk populations (Aggarwal et al., 2021)

Summary

15.1 Performing a General Survey

During the nurse's interactions with a patient, the nurse must be prepared to obtain vital data, assess the patient's status, and communicate openly with the patient. The patient's appearance, behavior, age, gender, culture, growth, and development will be rapidly assessed when meeting the patient. From these initial observations, the nurse should be able to ascertain if the patient requires immediate intervention or will need the help of additional health care by being able to distinguish between normal and abnormal findings. The cognitive status will also need to be addressed, and any abnormalities found in cognition will require further investigation. Vital signs, height, and weight will be gathered during the initial encounter, providing objective data used to determine the patient's current condition. To obtain this data, the nurse will need to be prepared. This preparation includes gathering appropriate instruments and refining the nurse's skills using eyes, ears, and touch. Throughout the nurse's various interactions with the patient, information will be exchanged, both verbally and nonverbally. An astute nurse will listen carefully to what the patient says and follow up as appropriate. The combination of these aspects in a generalized survey provides a thorough baseline for the patient's status.

15.2 Common Types of Anthropometric Measurements

The anthropometric measurements of height, weight, and BMI guide patient treatment plans allowing the nurse to personalize the patient's plan of care. Obtaining these measurements requires that nurses utilize the proper equipment. Standing scales and bariatric scales measure weight in ambulatory patients, whereas bed scales and sling scales are used in those with physical limitations. Although the ideal method for obtaining the height is using the stadiometer that requires the patient to stand upright, the demi-span aids in calculating the height for those unable to stand. The BMI is calculated from the height and weight data of a patient and is used to classify those results as either underweight, healthy weight, overweight, obese, or severely obese. This categorization provides data to help guide the patient's plan of care.

15.3 Vital Signs

Vital signs provide a snapshot of health for the patient and are routinely assessed to monitor a patient's progression. The nurse must make sure the right equipment and right methods are used to obtain accurate results. Even understanding the patient's history can affect the method and equipment needed for vital signs. Vital sign monitoring occurs at routine intervals depending on the status of the patient, but the nurse can always assess these outside of these prescribed times, as nursing judgment dictates. Because vital signs are measured routinely on a patient, the nurse must be able to quickly validate and document these results. An abnormal vital sign or one outside of the patient's trends requires further investigation. Once the vital signs are obtained and validated, they must be documented to facilitate communication with the entire healthcare team.

15.4 Temperature

In conclusion, the simple task of obtaining a patient's temperature provides needed health information for the patient, which is why it is considered a vital sign. The ideal body temperature is 98.6°F (37°C), but small fluctuations are normal. The environment can hasten heat loss or heat gain through the mechanisms of heat transfer, which are conduction, convection, radiation, and evaporation. An infection, inflammation, malignancy, or autoimmune condition may be responsible for the development of a fever. Obtaining a patient's temperature may be done through a variety of methods, depending on the patient, situation, and availability of equipment. Temperature abnormalities, outside the normal range, can indicate the presence of infection, exposure to harsh environment, or the need for further investigation.

15.5 Heart Rate

The pulse must be palpated as part of obtaining vital signs. The pulse provides valuable information about the circulatory system because it mimics the heart rate and illustrates the perfusion of the extremities. The radial pulse is the preferred site in most patients because of its peripheral and convenient location. In infants, auscultation of the apical pulse should be used to determine the heart rate, rather than the radial pulse. When a nurse is palpating the pulse, the rate, rhythm, and volume of the blood should be assessed and documented. Pulse abnormalities may be indicative of metabolic changes, cardiac complications, vascular conditions, or even activity levels.

15.6 Respiration

Assessing respirations is another component of the obtainment of vital signs and illustrates the efficiency of the respiratory system. When the nurse is preparing to obtain respirations, the normal range for the patient's age and the patient's trends should be known. To complete this assessment, the nurse should assess the respiratory effort by determining the respiratory rate, rhythm, and depth. Any difficulty breathing should be documented and communicated to the provider. The nurse should also be prepared to obtain the oxygen saturation of the blood via the pulse oximeter. This piece of equipment shows not only the oxygen saturation but also the pulse rate. Abnormalities identified in the respiratory assessment may be due to acid-base imbalances, pulmonary complications, neurological issues, and increased metabolism.

15.7 Blood Pressure

Blood pressure is the final vital sign obtained during the vital sign collection since it is often the most uncomfortable due to the squeezing. This measurement provides critical information on the cardiovascular system and takes specific equipment to obtain. An appropriately sized blood pressure cuff or sphygmomanometer, a stethoscope, and a trained nurse are all needed to obtain an accurate blood pressure reading. Once the blood pressure cuff is in place, the nurse assesses the location of the pulse, places the stethoscope over the pulse, and inflates the cuff. As the cuff slowly deflates, the nurse listens carefully for the origin and disappearance of the Korotkoff sounds to determine the systolic and diastolic results, being careful not to be confused by the auscultatory gap. Once the results are obtained, the nurse determines the pulse pressure and verifies the results, comparing them to both the normal ranges for the patient's age and the individual trends. Abnormalities may be due to a host of issues such as abnormalities in the heart's contraction, the diameter of the blood vessels, and the amount of circulating blood.

Key Terms

accessory muscle use sign of respiratory distress, using muscles other than the diaphragm and intercostal muscles to aid in the process of breathing
anthropometric measurement noninvasive quantitative measurement of the human body; examples are height, weight, body mass index, body circumferences, and body fat measurements
anthropometry tape flexible measuring tape used to determine body circumferences
antipyretic medication that alleviates a fever
apnea the cessation of breathing
arrhythmia abnormal heart rate and rhythm
asystole the heart fails to contract and produce a pulse
atelectasis collapsing of the alveoli
auscultatory gap a brief absence of sound between the origin and disappearance of the Korotkoff sounds during obtainment of blood pressure
bariatric scale instrument to measure weight in obese and severely obese individuals
bed scale instrument to measure weight in immobile patients or patients on bed rest, a component of most hospital beds
body mass index (BMI) a value that is calculated from an individual's height and weight to provide as measurement relative to the standards for ideal body weight
bradycardia pulse rate slower than 60 beats per minute
bradypnea a slower-than-normal respiratory rate (fewer than twelve breaths per minute in adults) at rest
cardiac output total amount of blood ejected by the heart into circulation in one minute, measured in liters
Cheyne-Stokes respiration a cyclical breathing pattern involving periods of apnea and hyperventilation that often occurs at end of life
conduction mechanism of heat transfer through direct contact with an object
convection mechanism of heat transfer that occurs through air or water currents
cyanosis a bluish or dusky discoloration of the skin and mucous membranes caused by hypoxia
demi-span the preferred method of obtaining height for patients unable to stand; the technique involves measuring the distance in centimeters from the middle of the sternal notch to the tip of the middle finger while the arm is at a 90-degree angle to the body and using a conversion factor to compute height
diaphoresis sweating
dyspnea difficult, labored breathing pattern

evaporation the transfer of heat through the change of water from a liquid to vapor
hypertension an elevated blood pressure
hyperthermia core body temperature hotter than 105.8°F (41°C)
hypotension a lowered blood pressure
jaundice yellowing of the skin and sclera
Korotkoff sound the pulsating, tapping sound heard with a stethoscope as blood flows through the brachial artery
Kussmaul respiration a deep, rapid breathing pattern associated with metabolic acidosis
medulla the respiratory control center of the brain
Modified Early Warning Score (MEWS) measurement tool that analyzes vital sign data and level of consciousness, which are used to provide an early warning for deterioration in the patient's status
narrowed pulse pressure pulse pressure less than 25 percent of the systolic blood pressure (i.e., 110/85)
normothermia normal range of body temperature
pallor paleness of the skin and mucous membranes
piloerection goosebumps
pulse oximeter instrument that measures the oxygen saturation of the blood
pulse pressure difference between the systolic and diastolic blood pressure; normally about 40 mm Hg
pyrexia fever
pyrogen fever-inducing substance
radiation mechanism of heat transfer through infrared waves
respiratory depression slower than normal respiratory rate, generally experienced as a side effect of anesthetics and opioids
skinfold calipers instrument used to assess the thickness of skinfolds
sling scale a scale used for completely immobile patients using a sling or piece of large fabric
sphygmomanometer instrument used to obtain a blood pressure reading, also known as a blood pressure cuff
stadiometer a height ruler for patients able to stand
stethoscope medical equipment used to amplify internal body sounds for its user
stroke volume (SV) the volume of blood pumped out of the left ventricle of the heart during each systolic cardiac contraction
tachycardia heart rate faster than 100 beats per minute
tachypnea a respiratory rate that exceeds 20 breaths per minute
thermometer instrument used to measure body temperature
thermoregulation the body's ability to maintain its temperature within a normal range
vasoconstriction decrease in the blood vessel diameter
vasodilation increase in the diameter of the blood vessel
vital sign a marker of physiological homeostasis and essential in the analysis of monitoring patient progress; obtained by measuring body temperature, pulse, respiratory rate, and blood pressure
widened pulse pressure pulse pressure more than 100 mm Hg (i.e., 174/69)

Assessments

Review Questions

1. Prior to obtaining vital signs, a nurse gathers a thermometer, a manual blood pressure cuff, and a pulse oximeter and checks the patient's vital sign trends. What item did the nurse fail to obtain?
   a. anthropometry tape
   b. MEWS
   c. sphygmomanometer
   d. stethoscope

2. What observation could represent an early sign of hypoxia?
   a. aggression
   b. confusion
   c. depression
   d. restlessness

3. After obtaining the height and weight, the nurse determines that the patient's BMI is 27. In what category is this patient?
    a. healthy weight
    b. severely obese
    c. obese
    d. overweight

4. A patient using a walker is visiting the clinic for a preoperative appointment for gastric bypass surgery. The patient's weight at the last appointment was 425 lb (192.8 kg). The nurse needs to obtain vital signs, height, and weight. The patient can stand without assistance. What scale should be used?
    a. bariatric scale
    b. sling scale
    c. stadiometer
    d. standing scale

5. A nurse is caring for a patient following an appendectomy. The facility's policy states that vital signs should be obtained immediately, then in fifteen-minute increments for the first hour, then in thirty-minute increments for the next two hours, then hourly for the following four hours. Vital signs were obtained immediately after surgery at 1515 and then again at 1530. When is the next time that vital signs should be obtained?
    a. 1545
    b. 1600
    c. 1630
    d. 1730

6. A patient's bed is by an air vent in the hospital room. The nurse notes that the patient's temperature decreased from 99.8°F (37.7°C) to 96.9°F (36.1°C). What type of heat transfer associated with the air vent may have contributed to the lowering of the patient's temperature?
    a. conduction
    b. convection
    c. evaporation
    d. radiation

7. The nurse is caring for a 92-year-old female who is admitted to the hospital for a right hip fracture. No infection is noted per recent laboratory values and provider notes. Which temperature trend would the nurse expect for this patient?
    a. 97°F to 97.5°F (36.1°C to 36.4°C)
    b. 100.4°F to 100.9°F (38°C to 38.3°C)
    c. 98.9°F to 99.4°F (37.2°C to 37.4°C)
    d. 99.5°F to 99.9°F (37.5°C to 37.7°C)

8. The nurse is obtaining the pulse in the antecubital space. What pulse is this?
    a. apical pulse
    b. brachial pulse
    c. carotid pulse
    d. temporal pulse

9. A nurse assesses a patient's pulse and finds it has an irregular rhythm. What diagnosis causes an irregular rhythm?
    a. atrial fibrillation
    b. broken bone
    c. hemorrhage
    d. right-sided heart failure

10. A nurse is caring for a patient who was admitted to the hospital following surgery for hernia repair. The patient's history includes diagnoses of COPD, hypertension, and peripheral vascular disease. The patient was also successfully treated for prostate cancer via a prostatectomy last year. Upon assessment, the nurse finds that the dorsalis pedis pulses are weak. What may be the cause of the weak pulses?
    a. COPD
    b. hypertension
    c. peripheral vascular disease
    d. prostate cancer

11. A respiratory rate of 12 breaths per minute would be expected at what age?
    a. 2 months old
    b. 2 years old
    c. 6 years old
    d. 80 years old

12. A nurse obtains a blood pressure reading of 133/74. In what category would this reading be classified?
    a. normal
    b. elevated
    c. stage I hypertension
    d. stage II hypertension

Check Your Understanding Questions

1. A nurse should observe which four elements of nonverbal communication in patients? What is the importance of each?
2. A nurse needs to obtain a height on a bedridden female patient. How would the nurse accomplish this task?
3. A nurse obtains a pulse of 90 beats per minute in a 19-year-old. The normal range for this age is 60 to 100 beats per minute, and this patient's trends are 46 to 71 beats per minute. What action should the nurse take?
4. Explain why athletes and fit adolescents have a slower heart rate than adults.
5. A patient is diagnosed with atelectasis following a cholecystectomy. Explain the rationale for the development of atelectasis.
6. Why would a nurse expect a patient diagnosed with atherosclerosis to also have hypertension?

Reflection Questions

1. What might a nurse observe in a patient with hypoxia and respiratory distress?
2. A nurse is working on the oncology unit and caring for an infant with leukemia who is receiving chemotherapy. After obtaining an abnormally high axillary temperature, what priority actions should the nurse consider?

Critical-Thinking Questions about Case Studies

1. Refer to Unfolding Case Study #3: Part 1.
   How might the nurse go about determining if the patient has any cultural preferences?
2. Refer to Unfolding Case Study #3: Part 2.
   How might the patient's tachycardia affect overall cardiac output?
3. Refer to Unfolding Case Study #3: Part 3.
   What other factors may have been contributing to the increased respiratory rate?

What Should the Nurse Do?

1. The day-shift nurse enters a patient's room just after receiving report from the night-shift nurse. The patient is leaning over the bedside table, eating breakfast, and talking on the phone to a family member. Food is

dribbling out of the patient's mouth and onto the gown. When the nurse enters the room, the patient gets off the phone and says to the nurse, "What do you have for me today?" Which findings would require further investigation by the nurse?

a. interaction with family member
b. dribbling food
c. client's statement
d. client's posture

2. A nurse is providing discharge instructions for a patient with a BMI of 31. The patient was admitted for an appendectomy and holds a job as a full-time construction worker and part-time mover. Which should be included in the patient's postoperative plan and why: decrease or increase caloric intake?

3. A nurse is obtaining vital signs on a patient recovering from a total knee replacement. The patient has just returned from a physical therapy session. The patient's trends for hospital stay include the following ranges:
   Temperature: 97.2°F (36.2°C) to 99.1°F (37.3°C)
   Heart rate: 64 to 82
   Respiratory rate: 16 to 22
   Blood pressure: 128 to 146/70 to 72
   The nurse obtains the following vital signs:
   Temperature: 96.9°F (36.1°C)
   Heart rate: 80
   Respiratory rate: 22
   Blood pressure: 102/50
   Which should be the nurse's first action?

4. A nurse is caring for a patient recovering from spinal surgery on postoperative day 1. The patient's medical history includes type 2 diabetes mellitus and high cholesterol. The patient is currently receiving pain medications: oral ibuprofen every eight hours and IV morphine via a patient-controlled analgesia pump. The nurse obtains the patient's vital signs while the patient is sleeping and notes an abnormal respiratory rate of 8 breaths per minute. What may be the cause of the abnormal respiratory rate?

a. diabetic ketoacidosis
b. opioid use
c. pain leading to atelectasis
d. severed innervation to the diaphragm

A nurse on the medical unit is caring for four patients and just received the vital sign data from the patient care tech. The patient care tech used a digital vital sign machine and a standard adult cuff for all the patients but made sure to clean it between each use.

- Patient 1: A patient admitted with kidney stones awaiting stent placement. T 99.1, P 104, RR 20, BP 136/82, Oxygen saturation 100 percent on room air
- Patient 2: A patient admitted with heart failure with pulmonary edema. T 97.1, P 110, RR 24, BP 88/42, Oxygen saturation 91 percent on 2 L of oxygen
- Patient 3: A patient admitted with chronic renal failure and atherosclerosis. T 98.2, P 90, RR 18, BP 175/101, Oxygen saturation 97 percent on room air
- Patient 4: An older adult patient admitted with failure to thrive. T 96.9, P 68, RR 18, BP 92/49, Oxygen saturation 96 percent on room air

5. Who should the nurse see first and why?
6. What intervention should the nurse provide for patient 4 and why?

Competency-Based Assessments

1. Develop adaptive questions for the provided patient conversation: "I decided to come to the doctor's office today because I have been having a nagging cough mostly at night. It has been going on for the past month, but I haven't missed work or anything. My wife just made me come in, probably because I am keeping her up

at night."

2. Using the BMI chart in the previous section, or one of your choice found in a google search, and patient data of male, 34 years old, height of 5′11″ and weight of 178 lb (81 kg). Calculate the patient's BMI and determine category.
3. Develop a flowsheet for documenting routine vital signs on a medical unit.
4. Review the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student Resources tab of your book page on openstax.org.

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CHAPTER 16

Pain Assessment

FIGURE 16.1 Pain is considered the fifth vital sign and an important aspect of a comprehensive assessment. When patients suffer from impaired comfort and pain, nurses can provide compassionate patient-centered care. (credit: "RE:Union – A story of cancer in the family" by "mescon"/Flickr, CC BY 2.0)

CHAPTER OUTLINE

16.1 The Pain Process
16.2 Responses to Pain
16.3 Factors Affecting Pain
16.4 Pain Assessment
16.5 Pain Management

INTRODUCTION According to the International Association for the Study of Pain (2021b), pain is defined as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage." Pain can be acute or chronic, mild or severe, and expressed in many different ways. Pain is triggered by a perceived danger or stress and tells the body to withdraw from threatening stimuli. Most pain resolves after the painful stimulus is removed and the body has healed, but sometimes pain persists despite removal of the stimulus and apparent healing of the body.

Pain is a subjective experience and can be influenced by biological, psychological, and social factors. Pain affects people in every aspect of health care, requiring nurses to be able to assess, manage, and treat it. Pain is subjective, meaning the patient defines the pain (ANA Center for Ethics and Human Rights, 2018). Patients can express pain through verbal and nonverbal behaviors. Some patients may rate their pain on a pain scale while other patients can only exhibit nonverbal cues such as grimacing, crying, and vital sign changes.

Because the experience of pain has so many variables, pain assessment and management must be comprehensive to be effective. Nurses must perform frequent comprehensive pain assessments to determine what pain

interventions would be most effective for each patient. Pain management plans must be individualized and involve the patient and healthcare team. Pain is one of the most common reasons for patients seeking care, and treating pain must be a top priority for healthcare providers in all settings.

16.1 The Pain Process

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the physiologic process of pain
- Analyze the gate control theory of pain
- Identify the classifications of pain

In order to assess and manage pain effectively, nurses must first understand the physiologic process of pain. Painful stimuli travel through the central nervous system via the pain pathway to the brain where the brain processes and initiates a response. The body's response to pain is dependent on the classification of pain and any factors affecting pain.

Pain can be classified by duration, location, and cause. Pain can be acute, chronic, localized, referred, or idiopathic. Nurses must know how to classify pain to effectively treat the pain. Pain can also be affected by biological, psychological, and social factors. The patient's age, attitude, emotions, or culture can affect how they perceive pain and how they want the pain to be treated. All these factors play a role in how nurses approach pain management for each patient.

The Physiologic Process of Pain

Pain can be processed physiologically and emotionally through the body. Pain motivates the individual to withdraw from dangerous stimuli, to protect a damaged body part while it heals, and to avoid similar experiences in the future. Pain can resolve after the stimulus is removed and the body has healed, but sometimes pain persists. Pain can also occur in the absence of a stimulus, damage, or disease.

Sensory receptors in the peripheral nervous system called nociceptors play an important role in the pain process. A **nociceptor** is designed to respond to potentially damaging stimuli by sending nerve signals to the spinal cord and brain. The process by which painful stimuli are detected by nociceptors and begin to send the pain signals from the peripheral nervous system to the brain is called **nociception** (Chen et al., 2023). After nociception occurs, the body processes the pain through four major steps: transduction, transmission, perception, and modification (Figure 16.2).

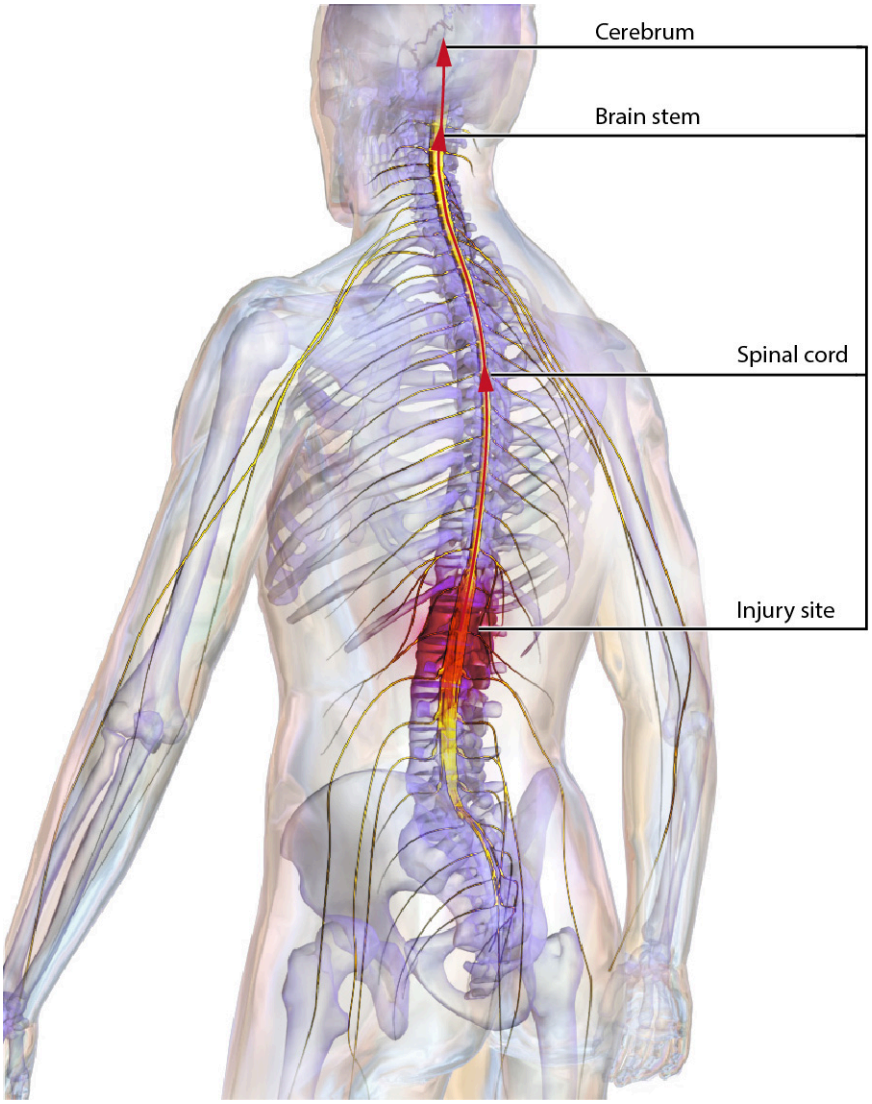

FIGURE 16.2 Nociception is the process by which the body sends painful stimuli from the peripheral nervous system to the brain, where it is processed and a response is formed. (credit: modification of "Blausen 0822 SpinalCord.png" by "BruceBlaus"/Wikimedia Commons, CC BY 3.0)

Transduction of Pain

The starting point of the body passing painful stimuli to the brain is called **transduction of pain**. It occurs when activated nociceptors in the peripheral nervous system send a pain signal to the central nervous system, starting in the dorsal root of the spinal cord (Yam et al., 2018). Activation of nociceptors can occur internally or externally, such as from a cut from a knife, an infection, or a sprained ankle (Answine, 2018).

There are several types and functions of nociceptors:

- Thermal nociceptors are activated by heat or cold, such as a hot pan.
- Mechanical nociceptors are activated by excess pressure or mechanical deformation, such as a finger getting caught in a car door. They also respond to incisions that break the skin surface.
- Chemical nociceptors are activated by a wide variety of spices commonly used in cooking. For example, capsaicin is a compound in chili peppers that causes a burning sensation of the mucous membranes.

Transduction of pain is the first step of the pain process. Once the spinal cord receives the pain signal, the next step is transmitting the pain signal from the spinal cord to the brain.

Transmission of Pain

The spinal cord, brain stem, and cerebral cortex are all involved in the transmission of pain (Yam et al., 2018). After the nociceptive signal is activated, **transmission of pain** sends the pain signal through the central nervous system.

The pain signal is sent from the spinal cord to the nucleus of the brain stem, which initiates the brain's perception of pain (Chen et al., 2023). The pain signal is categorized as a thermal, mechanical, or chemical nociceptor. The brain then localizes the pain and creates an appropriate physical or emotional response (Answine, 2018).

Perception of Pain

After the brain stem receives the pain signal, it is sent to the cerebral cortex where the brain perceives the severity of the pain. When the brain receives the nociceptive signal, it perceives the message as pain to activate the body's defense to the perceived threat (Yam et al., 2018). The perception of pain occurs when the brain becomes aware of the pain through the cerebral cortex and determines an appropriate response to protect the body (Answine, 2018). For example, when a person stubs their toe, the brain perceives the painful stimuli and signals the body to take action. The person may grab their foot or cry out to express their pain. Individuals may perceive pain differently and perception can be altered due to many different factors. Past experiences, external factors, other health issues, and environmental differences are just a few things that can affect the perception of pain.

Modification of Pain

There are many factors that can affect the perception of pain; and there may be situations where the brain may modify pain signals in order to protect the body. The **modification of pain** occurs when the brain changes the intensity of the pain signal based on the situation that originated the pain signal (Answine, 2018). For example, a person may get injured from a dog bite, but the brain chooses to ignore the pain signal so the person can run away from the dog.

A chemical called a **neurotransmitter** carries messages between neurons to communicate throughout the body. Many neurotransmitters, such as norepinephrine and serotonin, can be involved in modifying the pain signals the brain receives (Answine, 2018). Nonpainful signals, such as electrical nerve stimulation, touch, or pressure can help counteract the severity of the pain signals. This is part of the gate control theory of pain.

The Gate Control Theory of Pain

The gate control theory of pain was developed by Ronald Melzack and Patrick Wall in 1965. Their research helped explain how sensory and psychological aspects affect how patients perceive pain (Campbell et al., 2020). The gate control theory states that the central nervous system can use neurological "gates" to determine when pain is felt. These "gates" determine which pain signals are allowed through to the brain and acts as a survival mechanism for the body (Cleveland Clinic, 2022). When the "gates" are open, the pain signal can travel to the brain and be perceived as pain. When the "gates" are closed, the pain signal is blocked from traveling to the brain. If the body perceives pain in two different locations at the same time, one "gate" may close to prioritize a response for the other cause of pain. Individuals can also use methods such as massage and acupuncture to help the body close these "gates" to decrease painful stimuli.

LINK TO LEARNING

Watch this video to better understand the gate control theory (https://openstax.org/r/77gatecntrl) of pain.

The gate control theory states that different pain signals can be transmitted to the brain faster than others can. Signals such as touch or sensation can be received by the brain faster than signals that send pain or temperature to the brain (Cleveland Clinic, 2022). Stimulating signals such as pressure can help decrease the pain signals to the brain. This explains why clutching an injured extremity can help decrease the pain sensation.

The gate control theory acknowledges that there are many factors that can affect pain (Trachsel et al., 2023). Factors such as mental health disorders, mindset, stress, or lifestyle choices have been shown to affect how the brain perceives pain. These factors can prevent the "gates" from closing, which can increase the pain intensity and frequency.

Factors Affecting the Theory of Pain

Biological, psychological, and social factors can all affect how a patient perceives pain (Table 16.1). Nurses must

consider these factors while assessing and providing holistic nursing care for patients experiencing pain.

Biological Factors	Psychological Factors	Social Factors
• Age • Brain function • Cognitive function • Genetic sensitivity • Hormones • Illness • Inflammation • Injury, past or present • Medical diagnosis • Nociception • Obesity • Source of pain	• Anxiety • Attitudes • Beliefs • Coping mechanisms • Developmental stage • Emotional status • Expectations • Fatigue • Fear • Meaning of pain • Memory • Mood/affect • Sleep • Stress • Trauma	• Culture • Education • Environment • Ethnicity • Social support • Socioeconomic status • Spirituality • Values

TABLE 16.1 **Biological, Psychological, and Social Factors Affecting Pain**

Age is a significant biological factor in the perception of pain. Newborns and infants can feel pain but are unable to verbalize it. School-aged children and adolescents may try to be "brave" and rationalize the pain. Older adults are at increased risk for undertreatment of pain because they are less likely to report it and pain can present atypically with confusion and agitation. Older adults and patients with diabetes/neuropathy may also feel pain differently due to decreased sensations.

Psychological factors also play a considerable role in pain perception. A patient's expectations of pain can often increase or decrease the severity. If a patient believes they will have a lot of pain, their perception can increase. In contrast, if a patient believes an intervention will be effective, their pain may decrease (Heshmat, 2023). For example, a patient who believes physical therapy will decrease their pain may have better pain outcomes than a patient who believes physical therapy will not have any effect on their pain. The interpretation of pain can also have an impact on pain perception. How pain affects a patient's quality of life can change their perception of pain. For example, a patient who is having pain from chronic arthritis may perceive their pain differently than a patient who is having pain from delivering a baby (Heshmat, 2023).

It is important for nurses to understand how social factors can affect a patient's perception of pain. Factors such as culture and socioeconomic status can influence how a patient perceives and articulates their pain (Heshmat, 2023). Certain cultures may be more expressive in their pain than others, and patients may hide their pain in fear of judgment of their socioeconomic status. For example, people from Asian cultures are more stoic and less vocal, while people from Middle Eastern cultures may be more vocal about their pain.

The complex interactions between factors affecting pain and individual perception can create a wide range of reactions to pain (Trachsel et al., 2023). Pain management must be multimodal and different for each patient to effectively treat pain.

Emotional State

Pain is always defined as a sensory and emotional experience. The patient's emotional state and pain go hand in hand, especially in patients with chronic pain. Research has shown that patients with chronic pain have higher rates of negative emotions such as anxiety, depression, and frustration (Gilam et al., 2020). Both negative and positive emotions can shape a patient's perception of pain. Research has also shown that patients with negative emotions such as anxiety tend to have a lower pain threshold (Heshmat, 2023), but positive emotions can decrease pain severity. This is why patients who practice relaxing activities such as listening to music can have reduced pain (Kober et al., 2020).

Social and Cultural Environment

Social and cultural environments can play a large role in the perception of pain. Factors such as a patient's home environment and social support can affect pain perception. Patients who have supportive social circles have been shown to have improved pain outcomes. Social isolation can contribute to poor pain outcomes, especially in chronic pain and older adult patients (Chadwick et al., 2022).

Other patient populations who can be affected by social factors include

- patients with a history of addictive disease;
- patients who are nonverbal, cognitively impaired, or unconscious;
- patients who endure pain without complaining due to cultural or religious beliefs;
- patients who are non-English speaking, where communication is a barrier; and
- patients who are uninsured or underinsured, where cost of medications is a barrier.

Nurses need to be aware of the impact of social environment and culture on pain management. Providing culturally competent care is essential to effective pain management for all patients.

CULTURAL CONTEXT

Cultural Competence in Pain Management

Cultural competence is essential in effective pain management. Patients who are non-English speaking are at higher risk for suffering from undertreated pain due to communication barriers. Interpreters can be helpful in ensuring patients are able to effectively express their pain and communicate their needs. Cost and availability are two cited barriers to having interpreters readily available in healthcare settings (Yelton & Jildeh, 2023). However, any intervention to ensure cultural competence in healthcare settings should be explored regardless of barriers. Cultural practices and beliefs play a big role in how a patient perceives pain and their expectations of pain management. Lack of understanding of cultural differences can damage the provider-patient relationship and create barriers to effective pain management. For example, some Asian cultures may not express their pain and appear reserved despite being in severe pain. Religion can also play a role in perception of pain. Some religions may believe that pain is a test of faith or part of the path God has planned for them. If nurses are not aware of these cultural differences, the patient could experience ineffective pain management (Givler et al., 2023). The different cultures and personal experiences of nurses can affect how pain is perceived in patients. Nurses should be aware of how their personal beliefs and experiences can impact how they care for patients who are different from them.

Classification of Pain

Classifying pain can help effectively evaluate and treat pain. Pain can be classified based on the severity, duration, or location. The World Health Organization (WHO) developed the analgesic ladder (Figure 16.3) in 1986 to help select analgesics for patients with cancer pain, but it can be broadened for managing pain appropriately for all patients. The ladder classified pain into three categories: mild, moderate, and severe. The WHO defines pain severity based on the type of medication needed to treat the pain. For example, mild pain may require only nonopioid analgesics while severe pain requires opioid medications such as morphine or fentanyl (Anekar et al., 2023).

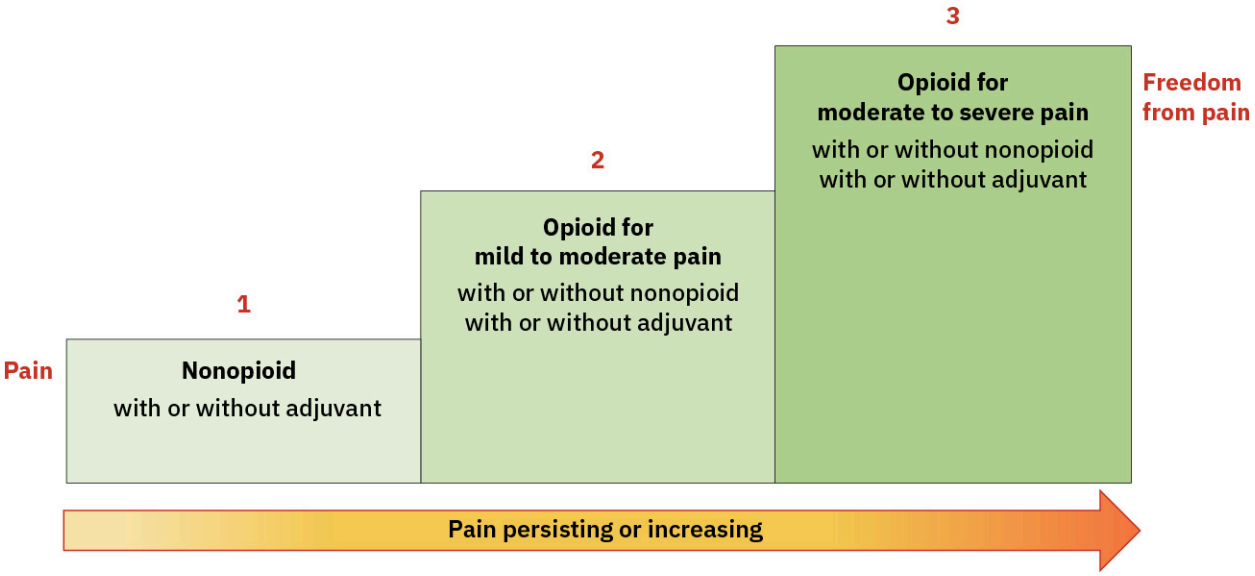

FIGURE 16.3 The WHO pain ladder classifies pain into three categories. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Pain can also be classified based on the duration or location of pain. Using tools such as pain location charts can help patients pinpoint the location of their pain, which may give healthcare providers a better idea of the cause of pain. The duration of pain can also help determine the potential cause and effective pain management strategies. For example, acute abdominal pain may indicate appendicitis whereas chronic back pain could indicate a past injury.

Duration

The duration of pain can determine the treatment method. Acute, chronic, or breakthrough pain are all defined based on the duration of time the pain persists. Acute pain is defined as Pain that is short in duration and caused by an acute event. For example, **acute pain** can be caused by an acute event such as a car accident or sports injury. Chronic pain is defined as pain that lasts longer than six months. Patients with chronic illnesses often suffer from **chronic pain** that can vary in severity. For example, patients with chronic pancreatitis often suffer from chronic abdominal pain that is caused by the inflammation of the pancreas. Acute pain that exists along with chronic pain is called **breakthrough pain**. Breakthrough pain persists even when interventions are present to treat chronic pain (Robertson, 2022). Patients receiving pain medication for chronic abdominal pain caused by pancreatitis may also suffer from breakthrough pain. If patients are receiving pain interventions but are still having severe pain, they may need to be hospitalized for further management to treat the breakthrough pain.

Acute Pain

Acute pain is a short-lived response that alerts the brain to an acute event caused by injury, trauma, surgery, or illness (Dowell et al., 2022). Acute pain can last a few seconds or a few months and is usually resolved when the acute event is treated (International Association for the Study of Pain [IASP], 2021a). Symptoms of acute pain can include numbness, tingling, sharp, throbbing, and stabbing pain (IASP, 2021a). Acute pain may cause appetite changes, sleep disturbances, diaphoresis, changes in vital signs, and behaviors such as distraction, guarding, protectiveness, and restlessness. Examples of acute pain include postoperative pain; burns; acute musculoskeletal pain from conditions such as strains, sprains, and fractures; pain associated with labor and delivery; and pain from traumatic injury.

Because acute pain can vary in severity, the type of treatment may vary based on individual patient needs (Robertson, 2022). Treatment for acute pain may include rest, ice or heat, physical therapy, nonopioid medications, or exercise (IASP, 2021a). The first step in treating acute pain is identifying the cause and ensuring that patients receive treatment before the pain becomes severe. Acute pain is often resolved when the cause is treated, so identifying the cause is an important first step in treating acute pain.

Chronic Pain

Chronic pain is ongoing and persistent for longer than six months and is not always confined to a specific area of the body. Chronic pain often affects an individual's psychological, social, and behavioral responses that can influence

daily functioning. Causes of chronic pain can include chronic disease, injury, inflammation, or an unknown cause (Dowell et al., 2022). Chronic medical problems, such as osteoarthritis, spinal conditions, fibromyalgia, and peripheral neuropathy, are common causes of chronic pain. Chronic pain can continue even after the original injury or illness that caused it has healed or resolved.

It is estimated that one in five adults in the United States suffers from chronic pain (Dowell et al., 2022). People who have chronic pain often have physical effects that are stressful on the body. These effects include tense muscles, limited mobility, lack of energy, and appetite changes. Emotional effects of chronic pain include depression, anger, anxiety, and fear of reinjury. These effects can limit a person's ability to return to their regular work or leisure activities. Multiple factors can lead to chronic pain becoming more centralized, which can result in a decreased pain threshold. This can cause patients to experience an increased severity of pain and to need complex pain management (Dydyk & Grandhe, 2023).

LINK TO LEARNING

Chronic pain affects so many individuals in the United States and throughout the world. Observing a patient interview with someone who suffers from chronic pain (https://openstax.org/r/77chrpainintv) can be useful for nurses to understand how chronic pain affects everyday life and the many different ways to manage chronic pain.

Location

Pain can be defined based on location. Sometimes it is easy for patients to identify the location of their pain and sometimes it may be difficult. Pain perceived at a location other than the site of the painful stimulus is called **referred pain**. The abdomen, extremities, and head are common areas to experience pain. Pain location charts can be helpful for patients to describe their pain (Figure 16.4).

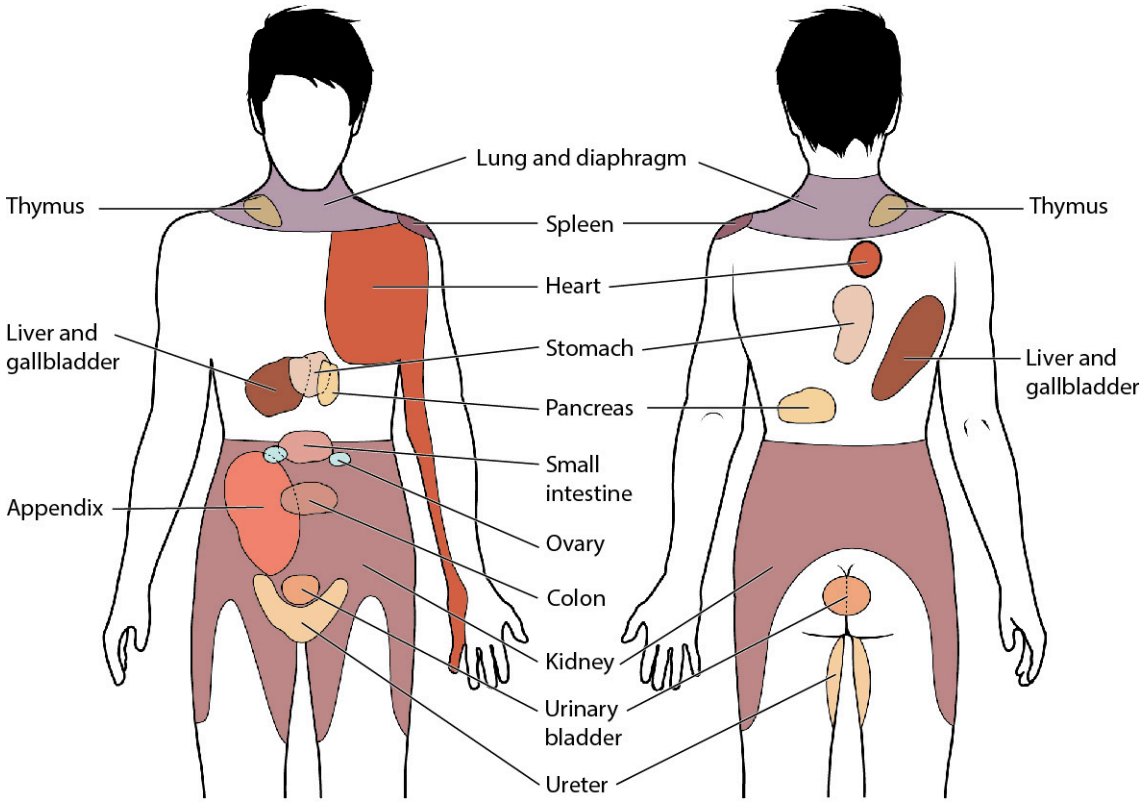

FIGURE 16.4 Pain location charts can be helpful for patients to identify where their pain is felt on their body. Locating the pain can help healthcare providers in developing effective treatment plans. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Identifying the location of a patient's pain can better help healthcare providers effectively assess and manage pain. Pain location charts show areas of the body, and the patient can point to a specific area where they are feeling their

pain. Areas of pain such as knee pain can result from different causes based on location (Askinazi, 2023). For example, pain above the knee can be caused by inflammation while pain at the kneecap can be caused by a stress fracture. Location may be hard to determine for certain types of pain, but it can be helpful in the pain assessment and treatment plans.

Cutaneous Pain

Pain that is perceived from the skin is called **cutaneous pain**. Cutaneous pain is often acute pain that is resolved after the underlying injury or condition is treated. However, sometimes cutaneous pain can become chronic. Cutaneous nociceptors respond to heat, cold, and mechanical and chemical stimuli. Causes of cutaneous pain can include diabetes, autoimmune diseases, and other painful skin conditions (Gudin et al., 2022).

Patients who have diabetes often suffer from skin infections that can become painful. Other skin conditions such as shingles and dry skin can cause cutaneous pain. Shingles is caused by the virus that causes chickenpox and creates a vesicular rash that is painful and itchy. Autoimmune diseases such as lupus can cause inflammation, rash, and lesions that can cause cutaneous pain (Stucky & Mikesell, 2022). Many patients who suffer from cutaneous pain can also experience pain elsewhere in their body at the same time. Cutaneous pain can often be easy to identify due to outward signs of the cause of pain, such as cuts, burns, swelling, rashes, and bruising.

Visceral Pain

Visceral structures are internal organs such as the stomach, kidneys, spleen, and appendix. Visceral structures are highly sensitive to stretch, ischemia, and inflammation. When these internal organs are injured or damaged it creates **visceral pain** (Ford, 2019). Visceral pain is diffuse, difficult to locate, and often referred to as a distant, usually superficial, structure. It may be accompanied by nausea and vomiting and vital signs changes. Visceral pain may be described as sickening, deep, squeezing, aching, pressure, and dull. Visceral pain can be caused by gallstones, appendicitis, or irritable bowel syndrome (Santos-Longhurst, 2018).

Visceral pain can be difficult to locate due to the pain being internal, and patients often struggle to pinpoint an exact location. Unlike cutaneous pain, visceral pain does not typically show any outward signs of the cause of pain, which can make it difficult to locate.

Somatic Pain

Pain initiated by stimulation of nociceptors in ligaments, tendons, bones, blood vessels, fascia, and muscles is called **somatic pain**; it is a dull, aching, poorly localized pain. Somatic pain can be aching, deep, or superficial. For example, a ligament tear will cause deep somatic pain whereas a burn will cause superficial somatic pain. Somatic pain can be caused by broken bones, muscle stress, connective tissue diseases, joint pain, cuts, or burns (Santos-Longhurst, 2018). Somatic pain may show outward signs of the cause of pain such as a broken bone, cuts, burns, swelling, or bruising. Deep somatic pain may show no outward signs of the cause of pain, so further diagnostic testing may be needed to identify the location.

Referred Pain

Pain can radiate from one area to another. For example, back pain caused by a herniated disk can cause pain to radiate down an individual's leg. Referred pain is different from radiating pain because it is perceived at a location other than the site of the painful stimulus. For example, pain from retained gas in the colon can cause pain to be perceived in the shoulder. Referred pain can happen because all nerves are connected and sometimes the brain sends a pain signal to a different area from where the pain started (Watson, 2019).

Referred pain can be felt anywhere, which is why it can be difficult to diagnose. Common areas of referred pain are shoulders, neck, back, and jaw (Watson, 2019). For example, lower back pain can indicate that there is something wrong with the kidneys, and jaw pain could be an early sign of a heart attack. It is important that nurses are aware of these signs to help identify and treat serious conditions such as a heart attack.

REAL RN STORIES

Signs of a Heart Attack: Referred Pain

Nurse: Amy, BSN

Clinical setting: Emergency department
Years in practice: 2
Facility location: Teaching hospital in downtown Chicago, Illinois

Being in a big urban hospital, we see a wide range of patient populations, especially in the emergency department (ED). I enjoy working in the ED because you never know who will walk in the door and you must be ready for anything. I have seen a lot in my five years in the ED, but one patient story has always stuck with me.

I had been working in the ED for about a year, and it was my first night working as the triage nurse. As the triage nurse, my job was to quickly assess the patients when they first walk in and determine the level of care they would need. A younger woman walked into the ED with no signs of distress. She reported that she was having a "weird pain" in her armpit. She rated her pain a 3 out of 10 and described it as sharp and persistent. She said her pain had begun about an hour ago. I asked her a serious of standard triage questions to assess if she was having any other symptoms or pain elsewhere in her body. She reported no other symptoms and had a calm demeanor while speaking to me. She had no health history and appeared to be in good health. I initially assumed she may have injured her arm and an x-ray might show what was causing the pain. I determined her symptoms were not urgent and asked her to wait for the next available bed.

About thirty minutes later, the woman came back up to me and appeared pale, diaphoretic, and was complaining of the continued pain in her armpit and nausea. I immediately escalated her status and called my charge nurse. My charge nurse took one look at her and immediately brought her back to an exam room and asked the physician for an EKG and labs. My charge nurse seemed a little nervous, so I quietly asked her what was going on. She responded "I think this patient is having a heart attack. We need to get the provider right away." I was shocked. This patient's only symptom on arrival was mild pain, so how was she now having a heart attack? I then began to worry that I had missed something during triage.

My charge nurse helped stabilize the patient and transport her to the cardiac unit for further evaluation. After we had safely transported the patient, I told her what happened in triage and that I was terrified I had missed something. She explained to me that early signs of a heart attack could be referred pain to the arms, shoulders, or jaw. She said most of the time the pain is accompanied by other symptoms, but it is possible that the referred pain could be the only sign of a heart attack. She explained that as a new nurse, I may not have been aware of referred pain as a heart attack symptom and that I triaged the patient according to my knowledge. We worked together to help me understand how to identify potential referred pain for the future. A few years later, I had a similar patient come into the ED while I was the triage nurse. I was able to identify a potential heart attack early due to referred pain and stabilize my patient just as my charge nurse had done for me.

Etiology

The **etiology of pain** describes the specific cause of pain. Pain can result from various health conditions such as genetics, trauma, degenerative diseases, cancer, surgical procedures, infection, mechanical cause, or an unknown cause (Arumugam et al., 2019). Nociceptive, neuropathic, and idiopathic pain are all types of pain resulting from a specific cause. These causes can include heat, cold, chemicals, or neurological damage. The cause of pain can also be unknown.

Nociceptive Pain

Pain caused by stimulation of pain receptors by a mechanical or chemical cause such as heat or cold is called **nociceptive pain** (Ford, 2019). Because nociceptors are found everywhere in the peripheral nervous systems, nociceptive pain originates in the peripheral nervous system (Dydyk & Grandhe, 2023). The severity of nociceptive pain is directly related to the degree of injury. For example, stubbing a toe may cause mild pain while burns from a house fire may cause severe pain.

Nociceptive pain can be acute, chronic, somatic, or visceral depending on the duration and location of the pain. Nociceptive pain is usually acute, but sometimes the nociceptors may remain more sensitive to pain after the cause of pain has been resolved (Jacques, 2023). For example, a past head injury may have chronic pain due to frequent headaches even after the injury is treated.

Treatment of nociceptive pain is dependent on the duration and location of the pain. Acute nociceptive pain may

only need mild pain interventions, such as an ice pack for a stubbed toe. Chronic or more severe nociceptive pain may require a combination of pharmacological and alternative pain management (Jacques, 2023).

Neuropathic Pain

Pain caused by neurological damage or dysfunction is called **neuropathic pain**. Neuropathic pain can be peripheral and centralized, and it is estimated that 10 percent of adults in the United States suffer from neuropathic pain (Dydyk & Grandhe, 2023). Neuropathic pain results in stimulation from something that is not considered painful, but due to the neurological damage, the body perceives the stimuli as painful (Yam et al., 2018). Neuropathic pain can result from conditions such as diabetes, neurological disorders, cancer, trauma, or toxins.

Neuropathic pain can be described as burning, numbness, tingling, shooting, or stabbing and can occur in response to nonpainful stimuli such as temperature changes. Diabetes is one of the most common causes of neuropathic pain. Patients who have diabetes can develop numbness and tingling in their lower extremities due to decreased circulation. This can lead to pain, decreased sensation, and injury to the lower extremities. Central nervous systems disorders such as multiple sclerosis and Parkinson disease can cause neuropathic pain. Patients receiving cancer treatment such as radiation or chemotherapy may also experience neuropathic pain due to their treatments (Santos-Longhurst, 2018).

Neuropathic pain is generally undertreated because it typically does not respond to traditional analgesics. Medications such as tricyclic antidepressants and gabapentin are typically used to manage this type of pain. These medications work on blocking the sensation to the affected nerves. Many patients are not aware that their chronic condition could lead to neuropathic pain. Nurses should provide education for patients with these conditions to ensure that their pain is managed effectively.

PATIENT CONVERSATIONS

Assessing Neuropathic Pain in Patients Who Have Diabetes

Scenario: The nurse is caring for an established patient with diabetes who was admitted for hyperglycemia. The nurse is providing discharge education about the patient's diabetes home management and the patient is asking about pain management.

Patient: I often have numbness and tingling in my feet, and it really bothers me. Why is that happening?

Nurse: Are you having any pain right now?

Patient: No, not right now. But the pain comes and goes a lot when I am at home.

Nurse: That kind of pain is common in patients with diabetes. Diabetes can cause decreased circulation in your legs, which can lead to the numbness and tingling.

Patient: No one has told me that before.

Nurse: Have you ever spoken to your doctor about this pain?

Patient: No, I haven't seen my doctor in a long time. I probably should make an appointment with them.

Nurse: Many typical pain medications will not be effective for this type of pain, but there are some medications that are very effective. Let me help you set up an appointment with your doctor and we can work on getting you the right treatment plan for your pain.

Patient: Thank you very much. I had been taking Motrin but that was not helping. I am glad to hear there is something that may help my pain.

Idiopathic Pain

Sometimes patients can have pain without a known cause. This is called **idiopathic pain**, a chronic pain that is from an unknown origin. Idiopathic pain from an injury or medical condition may also persist long after the cause is healed. Medical conditions in which idiopathic pain may be present include fibromyalgia, multiple sclerosis, headaches, joint disorders, peripheral neuropathy, and irritable bowel syndrome (Jacques, 2021). Patients may

often experience idiopathic facial pain in the jaw, ears, or cheeks. Patients may feel dull, aching, throbbing, or tingling sensations in their face without any identified cause of pain (Cleveland Clinic, 2021).

Idiopathic pain can be difficult to diagnose. The symptoms of idiopathic pain can often be similar to those of other conditions. Healthcare providers tend to rule out other medication conditions before idiopathic pain is diagnosed. Because the underlying cause is not known, idiopathic pain can also be difficult to treat. A combination of medications and alternative therapies such as acupuncture, biofeedback, and meditation can help reduce pain (Cleveland Clinic, 2021).

16.2 Responses to Pain

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the physiologic response to pain
- Identify behavioral response to pain
- Identify affective response to pain

Patients can have many different responses to pain. The body perceives pain as a sign of danger and will immediately initiate responses to help the person stay safe. The sympathetic and parasympathetic nervous systems play a big role in physiologic responses to pain. Many patients may experience sympathetic body changes to a perceived threat of pain. Behavioral and emotional responses can also be observed in patients experiencing pain. Vocalization, facial expressions, movement, and negative emotions can all be responses to pain.

Patients may experience a wide variety of behaviors when in pain. Patients may lash out or become quiet and withdrawn when in pain. Patients in acute pain are more likely to vocalize their pain and exhibit facial expressions of pain. Patients suffering from chronic pain may struggle with anxiety and depression from the continued feeling of pain. Patients may even suffer from an extreme fear of pain and avoid any situation that may cause pain.

Physiologic Response

Pain warns a person of danger to prevent damage to the body (Arcuri, 2022). The **physiologic response** to pain is the body's involuntary responses to a painful stimulus such as inflammation or changes in heart rate and blood pressure. Physiologic responses can include sympathetic nervous system reactions and behavioral reactions such as facial expressions, emotions, vocalizations, and movement. Many of the observed nonverbal cues from patients are physiologic responses to pain.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Patient-Centered Care: Recognizing Physiologic Pain Response

Definition: Recognize the patient or designee as the source of control and full partner in providing compassionate and coordinated care based on respect for patient's preferences, values, and needs.

Knowledge: Demonstrate comprehensive understanding of the concepts of pain and suffering, including physiologic models of pain and comfort.

Skill: Assess presence and extent of pain and suffering. The nurse will:

- Focus on the duration, location, and etiology of the patient's pain.
- Ask the patient how long the pain has lasted to determine if the pain is acute, chronic, or breakthrough pain.
- Ask the patient to identify the location of the pain.
- Ask the patient to describe how the pain feels and what causes or makes the pain worse to try to determine the cause of pain.

Attitude: Appreciate the role of the nurse in relief of all types and sources of pain or suffering.

Sympathetic Nervous System

The autonomic nervous system contains the sympathetic and parasympathetic nervous systems and regulates the involuntary physiologic responses of the body (Figure 16.5). The role of the sympathetic nervous system is to

respond to perceived stressful or dangerous situations. The main response from the sympathetic nervous system is the **fight-or-flight response**, which triggers the body to either run away from or fight a perceived threat. For example, the body may perceive an encounter with a wild animal as a threat. The sympathetic nervous system will activate and tell the person to run away from the animal to safety. The fight-or-flight response may not be activated in perceived less stressful situations, but the body may still illicit a sympathetic response (Yeater et al., 2021). For example, a patient may be experiencing postsurgical pain even with pain medication. The sympathetic nervous system may respond to the pain by elevating the heart rate and blood pressure.

The sympathetic pain response involves many automatic bodily functions such as:

- enlarging pupils to improve vision;
- slowing digestion to allow the body to use energy in other places; and
- increasing heart rate and blood pressure to improve circulation (Cleveland Clinic, 2022b).

Nurses may notice these nonverbal signs of pain in a patient even before the patient states they are in pain. Noticing sympathetic pain responses is especially important in patients who cannot communicate their pain. Patients who are unconscious, confused, nonverbal, young, or cognitively impaired may not be able to adequately express their pain.

Parasympathetic Nervous System

The **parasympathetic nervous system** opposes the sympathetic nervous system and regulates the automatic bodily functions in times of rest and relaxation. Once the perceived stress or threat is gone, the parasympathetic nervous system takes over and returns the body to its normal functioning (Cleveland Clinic, 2022a).

The parasympathetic response includes:

- constricting pupils to limit light;
- producing saliva and mucus to assist in digestion and breathing;
- lowering heart rate and blood pressure to reduce workload;
- directing energy toward digestion to help break down food;
- directing the pancreas to create insulin to regulate blood sugar; and
- relaxing muscles to assist with urination and defecation (Cleveland Clinic, 2022a).

These responses indicate to the nurse that the patient is experiencing adequate pain relief. In the same way that the nurse observes sympathetic responses to detect a patient's pain, the nurse may observe parasympathetic responses to determine if pain interventions are effective (Figure 16.5).

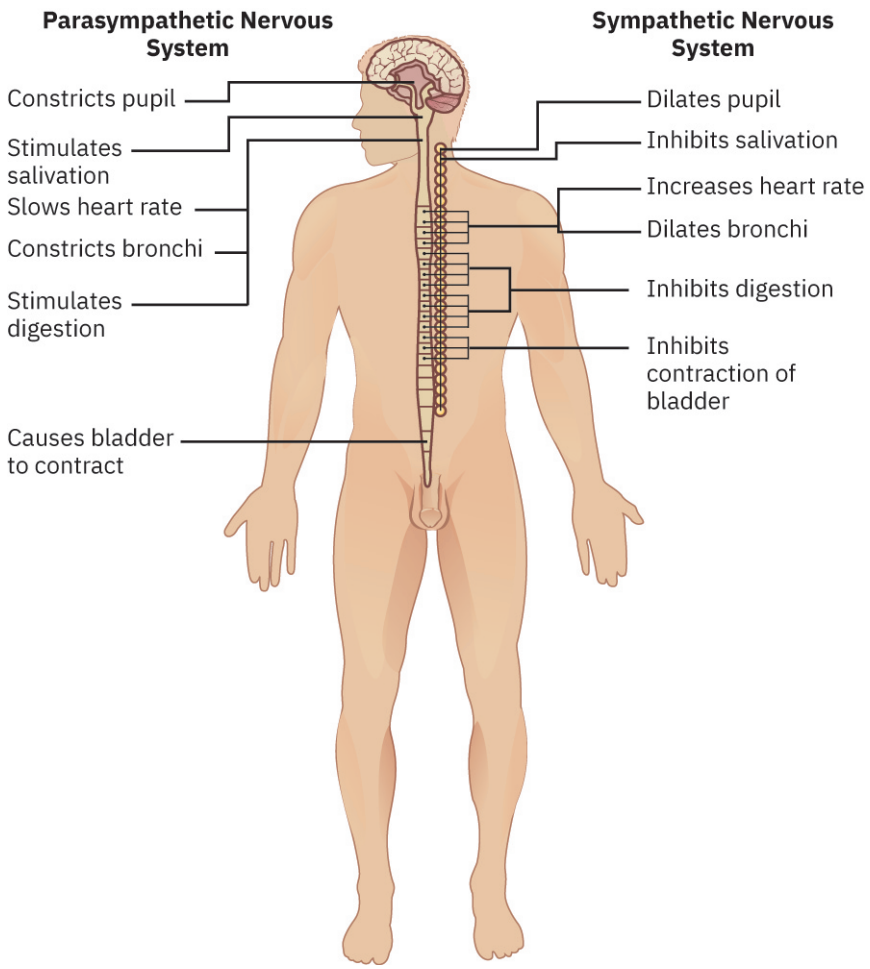

FIGURE 16.5 The parasympathetic and sympathetic divisions of the autonomic nervous system have opposite effects on various systems. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Vital signs can be an indicator of pain, and nurses can use vital sign measurements along with the patient's response to determine if pain interventions are effective. Measuring vital signs as an indicator of pain can be especially useful for patients who cannot verbalize their pain. Pain can cause an increase in blood pressure, heart rate, and respiratory rate. Abnormal vital signs can occur without pain, so it is important that nurses perform other methods of assessment for pain as well. Nurses can also measure vital signs to determine if they have normalized after pain interventions. For example, if a patient has elevated blood pressure and is exhibiting signs of pain, the nurse can assess their blood pressure after pain medication has been given to ensure that it has normalized. This can help indicate that the pain interventions are effective.

Behavioral Response

Behavior plays a big role in pain response. Nurses can easily observe behavioral responses to pain and can measure the severity of pain based on a patient's behavior. Noticing behavioral pain responses is especially important in patients who cannot communicate their pain.

Behavioral pain responses may include:

- facial expressions,
- vocalization,
- movement,
- emotions, and
- interactions with others.

Behavioral pain responses are often big reactions that others easily notice. For example, when a professional athlete gets injured during a game, everyone in the crowd understands the athlete is in pain due to their behavior. The

athlete may fall to the ground, grab the area of their injury, and yell out in pain (Figure 16.6).

FIGURE 16.6 Athletes are prone to injuries and can be seen publicly displaying behavioral responses to pain. (credit: "Injury" by Olympus Digital Camera/Flickr, Public Domain)

Vocalization

Patients will sometimes use sounds, noises, and words to express pain. This is called **vocalization**; and it most often occurs in acute pain of varying severity. Vocalization of pain includes crying, screaming, moaning, gasping, or grunting (Helmer et al., 2020). Patients can vocalize their pain by using pain rating scales. Asking patients to rate their pain on a numeric scale can be an effective way to assess patients for pain. Patients can also vocalize pain descriptors such as severity, duration, location, and type of pain.

The use of vocalization to express pain is used often in younger children (Helmer et al., 2020). Younger children have limited communication when trying to express pain. The most common way for infants to express discomfort is by crying. Older children may be capable of stating their pain using appropriate pain scales, such as the Wong-Baker FACES Pain Rating Scale, but may still use crying or yelling to express pain (Venable, 2018).

LIFE-STAGE CONTEXT

Behavioral Pain Response in Infants

Assessing pain in pediatric patients can be difficult, especially in infants. Nurses must be aware of behavioral responses to pain when caring for infants. Infants primarily express their needs through crying, but not all crying equates to pain. The FLACC (Face, Legs, Activity, Cry, Consolability) scale can be used to assess an infant's pain. The FLACC scale is recommended to be used in younger patients as it measures appropriate behavioral responses in young children. The FLACC scale scores patients' pain based on five criteria: facial expressions, body posture, activity, crying, and the ability to console (Trottier et al., 2022). The total score is 0 to 12, with each category receiving 0 to 2 points based on patient response. Nurses can try comfort measures such as swaddling, feeding, and rocking to ease the infant's crying. If no comfort measures work, the crying may be due to pain (Helmer et al., 2020).

Facial Expression

Facial expressions not only demonstrate emotions such as happiness, fear, or sadness, they can also demonstrate pain. Frowning, closing eyes, clenching teeth, opening the mouth, biting lips, grimacing, furrowing eyebrows, and scowling can all be used to express pain (Figure 16.7) (Cho & Hong, 2020).

FIGURE 16.7 Facial expressions such as grimacing, furrowing eyebrows, and closing eyes are a common way for patients to express pain. (credit: "The pain is brutal for these Marines 150306-M-IN448-056.jpg" by Sgt. Matthew Callahan/Wikimedia Commons, Public Domain)

Some research shows that social context can change the way a person expresses pain (Kappesser, 2019). For example, a young child may cry and use facial expressions to demonstrate pain around their parents. However, they immediately stop crying and try to smile when their older sibling comes into the room because they want to appear more mature. Another example is a person feeling comfortable enough to show facial expressions of pain in the presence of their partner rather than in front of a colleague or stranger (Kappesser, 2019). Patients may not feel comfortable showing facial expressions when in pain. They may try to hide their facial expressions in the presence of healthcare providers. It is important that nurses always help patients feel comfortable expressing their pain.

Body Movement

Patients may demonstrate pain through movement such as guarding, touching the location of the pain, withdrawing from touch, or tremors (Cho & Hong, 2020). Nurses may notice muscle tension and resistance to examination of the painful location.

Children often show pain through withdrawal of touch. While they may seek the comfort of their parents, they will often resist someone touching or manipulating the painful area due to fear of touch causing more pain. This can be difficult for nurses to assess the location of pain. Severe pain may require pharmacological interventions prior to assessment of the location of pain. Nurses must be mindful of the location of pain when doing a physical assessment. Visual assessment, diagnostic imaging, and descriptors of pain from the patient can help provide a comprehensive pain assessment without touching the painful area.

Social Interaction

The way that patients interact with others can change when they are in pain. Patients in chronic pain may withdraw

from social interactions and become isolated. This can make the pain worse and contribute to deteriorating physical health in patients (Bannon et al., 2021). When patients are in pain and around others, they may appear quiet, reserved, and uninterested (Oommen & Shetty, 2020). Nurses can educate patients that these social interactions are a normal response to pain and help them verbalize to their loved ones that these negative emotions are responses to pain. It is important that patients are able to verbalize their pain in social situations, so they do not become socially isolated and withdrawn. Research has shown that supportive social environments can help patients cope with pain (Bannon et al., 2021).

Affective Response

The **affective response** to pain refers to the emotional interpretation of pain, such as how uncomfortable the pain is. The affective response can help determine how much pain is felt (Cleveland Clinic, 2022a). Negative emotions such as fear and anxiety can be connected to pain. Because pain is a subjective experience, patients may have different emotional responses to pain. For example, an athlete with a knee injury may feel fear along with pain because they are worried the pain means a season-ending injury. Another patient feeling pain from a broken leg may feel anxiety along with the pain because they will not be able to work while recovering from their injury.

Interventions such as cognitive behavioral therapy, guided imagery, and meditation can help patients adjust their affective response to pain because they promote relaxation and decreased stress (Talbot et al., 2019). These interventions can help decrease negative emotions such as fear and anxiety while also decreasing the perception of pain.

Negative Emotion

Pain is an unpleasant sensation and associated with negative emotions. Negative emotions can include anger, frustration, fear, anxiety, depression, guilt, and sadness. Negative emotions can make it difficult to complete daily activities and can lead to social withdrawal. Everyone can feel negative emotions and they are not always connected to pain. However, it is important for patients to understand that pain can bring on negative emotions, especially anxiety and depression. If patients are not able to cope with negative emotions in healthy ways, it can lead to unhealthy consequences (Scott, 2022).

Accepting emotions and finding healthy coping mechanisms is essential to reducing pain and preventing negative consequences. Healthy coping mechanisms for negative emotions can include acceptance and understanding of the emotions, exercise, meditation, and lifestyle changes (Scott, 2022).

Anxiety

Anxiety often goes hand in hand with pain and is more commonly seen in patients with chronic pain. Pain can affect patients' daily lives and can have a big impact on their physical, mental, and social health. Many patients who experience anxiety with pain may also experience depression. Research shows that 65 percent of patients seeking help for depression also report pain symptoms (Harvard Health Publishing, 2021).

Anxiety and depression can make it harder to treat pain. Patients experiencing anxiety and depression may be less motivated to find ways to treat their pain and may be unable to focus on pain management strategies. Cognitive behavioral therapy, mindfulness, and medications can help treat anxiety, depression, and pain in patients. These therapies can be multimodal in that they can treat the negative emotions and the pain at the same time.

Fear

The perception of pain can be influenced by fear (Oommen & Shetty, 2020). Some patients may even have a phobia of pain. When that phobia of pain is extreme, it's called **algophobia**. Patients may experience anxiety and fear at the thought of pain. Algophobia can make patients more sensitive to pain and they may perceive normal activities as a potential cause of pain (Cleveland Clinic, 2021).

Fear of pain can cause patients to catastrophize pain. The act of **catastrophizing** is the picturing the worst possible outcome for a situation (Cleveland Clinic, 2021). Patients may be intensely focused on avoiding pain and can see the potential of pain in any situation. Patients may become anxious and withdrawn as they try to avoid situations that could cause pain. If patients are experiencing pain, they may avoid situations that they think can make their pain worse. Cognitive behavioral therapy and mindfulness can help patients deal with their fear of pain. Exposure to

potential painful situations can also help patients rationalize their fear of pain and continue living their daily lives.

16.3 Factors Affecting Pain

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe psychosocial factors affecting pain
- Identify physiological factors affecting pain
- Recognize psychological factors affecting pain

Psychosocial, physiological, and psychological factors can all affect pain. An important part of a pain assessment is recognizing the factors that could be influencing pain (Dydyk & Grandhe, 2023). Factors such as poor social support, past experiences, and age can make an impact on the patient's perception of pain.

These factors can negatively or positively impact a patient's perception and expectations of pain. A patient who has had negative past experiences with chronic pain and pain management may believe that their pain can never get better. A patient who has a good support system and believes that improving their lifestyle can heal their chronic pain may find their pain improving over time. It is important that patients are aware of the different factors that can affect pain and how different choices, lifestyle, and mindset can affect their perception and overall outcome of pain.

Psychosocial Factors Affecting Pain

A **psychosocial factor** is a social factor that relates to a person's perception of pain. Social factors can include mood, trauma, interpersonal relationships, environment, and education. Research shows that past experience and interpersonal relationships can have a large impact on the perception of pain. Patients who have pain due to past trauma may have a different perception of pain than someone who has never experienced pain. The impact of others can also affect patients' pain. For example, a patient may be more likely to report pain in the presence of a supportive environment than a patient who is alone.

Mood

Research shows that there is a connection between mood and pain. Mood disorders such as anxiety, depression, and bipolar disorder can impact the perception of pain. Emotions such as fear, frustration, and anger can also impact pain. If negative emotions persist during chronic pain, patients may be at an increased risk of suicide (Antioch et al., 2020). Chronic debilitating pain combined with a history of depression can give patients a feeling that there is no sense of pain relief.

Positive emotions can in turn help patients deal with their pain. Patients who are optimistic and have a positive lifestyle may view pain as a minor inconvenience rather than a life-altering change. Practicing interventions such as cognitive behavioral therapy, mindfulness, and relaxation techniques can help patients keep a positive mood while dealing with pain.

Distress

Negative attitudes in combination with pain can often lead to **distress**. Distress is experiencing extreme physical or mental suffering such as pain, anxiety, or sadness. Often patients find that their pain is beyond their ability to cope, which can cause distress when dealing with pain (Craig & MacKenzie, 2021). Distress when dealing with pain can lead to decreased quality of life, depression, anxiety, and catastrophizing (Fancourt & Steptoe, 2018). Patients may be so preoccupied with their pain that they begin to catastrophize and neglect other areas of their lives. For example, a patient with severe chronic pain may begin to think that there is no hope for pain relief and withdraw from their daily life. They may stop going into work, reduce physical and social activity, and turn to substance use as a coping mechanism. These poor lifestyle choices can lead to a decreased quality of life and more health complications.

Trauma

Pain and trauma are often interconnected. Many times, a patient's pain may be directly caused by trauma and therefore be a constant reminder of the traumatic experience (Jackson, 2021). Physical trauma such as car accidents or abuse can cause chronic pain. Patients may have chronic pain due to their injuries sustained in the traumatic experience or experience chronic pain due to **post-traumatic stress disorder (PTSD)**. Post-traumatic stress disorder (PTSD) is a psychiatric disorder where a person experiences lingering effects triggered by a past

traumatic event. These lingering effects can include chronic pain and can lead to anxiety and catastrophizing.

Research shows that childhood trauma can be linked to chronic pain later in life (Jackson, 2021). Childhood trauma may include physical, emotional, or sexual abuse, neglect, or parental separation. Children often do not know how to deal with traumatic experiences and may not receive support afterward, so they can have lingering effects of the trauma for many years. Research shows that treating the trauma can provide pain relief. Different types of therapy and mental health resources can help the patient deal with the trauma and any residual effects.

Interpersonal Factors

It is important for nurses to understand how social factors can affect a patient's perception of pain. Supportive environments may allow patients to be more open in voicing their pain. For example, a patient may be more open in discussing their pain in the presence of a loved one than when alone in a healthcare setting (Gilam et al., 2020). Factors such as culture and socioeconomic status can influence how a patient perceives and articulates their pain (Heshmat, 2023). Certain cultures may be more expressive in their pain than others, and patients may hide their pain in fear of judgement of their socioeconomic status.

The complex interactions between factors affecting pain and individual perception can create a wide range of reactions to pain (Trachsel et al., 2023). Perceived social rejection, lack of social support, and relationship struggles can impact a patient's perception of pain. A patient without adequate social support may view their pain as more unmanageable than a patient with a strong support system does.

Physiological Factors Affecting Pain

Physical factors that are related to a person's perception of pain is called **physiological factors**. Physiological factors can include age, developmental level, sex, ethnicity, and lifestyle choices. Research shows that physiological factors such as hunger, stress, substance use, and sedentary lifestyle can put a person at an increased risk for pain (Dydyk & Grandhe, 2023). Substance use may be used to try to relieve pain. Alcohol is often used by patients to self-medicate, but the pain-relieving properties are short-lived. Healthy lifestyle choices such as exercise, healthy foods, and sunlight can be used to decrease pain and prevent further health complications (Mills et al., 2019).

Developmental Level

The developmental level of the patient can impact how they perceive and express pain, especially in children. It is important to note that developmental level does not always correspond with the patient's age. For example, a patient with Down syndrome could be 18 years old but have the developmental level of a school-aged child due the cognitive effects of Down syndrome. Patients with childhood traumatic brain injuries could remain at a lower developmental level as they age.

Infants cannot verbalize pain and express all distress through crying. The nurse must use other behavioral cues and rule out other causes to determine if the crying is related to pain. Toddlers and preschoolers often have difficulty describing, identifying, and locating pain. Instead, pain may be demonstrated behaviorally with crying, anger, physical resistance, or withdrawal. School-aged children and adolescents are more responsive to explanations of pain.

Adults are able to verbally express pain and can understand most pain rating scales. However, adults who are developmentally delayed may express pain similar to how a child does. Pain in older adults can present atypically with confusion and agitation. Patients who are confused may have trouble perceiving and adequately expressing their pain. Pain is often underreported in patients of different developmental levels, so nurses must be aware that people of different developmental levels will express pain in very different ways.

Age

Just as children relate differently to pain based on their developmental levels, older adults can be at greater risk of chronic pain due to age-related health concerns. Older adult patients have a higher risk of illness or injury, which can lead to chronic pain (Mills et al., 2019). Older adult patients have a higher rate of chronic pain due to these age-related changes. Older adults are also less likely to express pain. Many patients have the attitude that pain is "just what happens with old age." Dementia and confusion can also make expressing pain more difficult (Mills et al., 2019). Patients who suffer from chronic conditions such as Alzheimer disease may not be able to recognize that they are in pain or adequately communicate how they are feeling. Many older adult patients suffer from social

isolation, which can further discourage them from seeking pain management.

CLINICAL JUDGMENT MEASUREMENT MODEL

Analyze Cues: Linking Physiological Factors to Pain

The nurse is performing an initial assessment on an older adult patient admitted for a urinary tract infection. The nurse observes that the patient is confused and does not know they are in the hospital. The patient is visibly distressed and states they are scared because they do not know where they are or where their spouse is. The nurse observes that the patient arrived at the hospital in a wheelchair and notes chronic back pain in their health history. The nurse notes that the patient has chronic pain medication listed on their home medication list. When the nurse asks the patient if they are in pain, the patient states "no" and continues to express distress that they are not at home with their spouse. However, the nurse notes that the patient continues to rub their back and struggles to move from the wheelchair to the bed. The nurse understands that confusion due to age in older adult patients can impact the patient's perception of pain. The nurse notes that the patient's vocalization of pain does not match the physical signs of pain and may be due to the patient's confusion. The nurse understands that further evaluation is needed to assess the patient's pain and factors that may impact their pain management.

Culture/Ethnicity

Culture and ethnicity can play a role in the perception and management of pain. Various cultures can express pain differently. For example, Asian cultures are typically more reserved when discussing pain while other cultures may be more vocal and expressive in their pain (Givler et al., 2023). Research has shown that chronic pain is more prevalent in developing countries (Mills et al., 2019). Cultures with fewer resources and less access to health care have higher risk of pain being underassessed and undertreated.

Research has shown that socioeconomic background may affect pain more than culture and ethnicity. Underrepresented communities often have limited access to health care and can be at higher risk of chronic pain, substance misuse, and opioid addiction (Dydyk & Grandhe, 2023). Patients may not have the education or financial stability to seek out care when dealing with chronic pain. Patients from an underrepresented community may have limited access to health insurance, financial stability, job security, and other factors that complicate their perception of pain and the ability to manage it. Patients suffering from chronic pain may be concerned about the cost of treatment or job security and may avoid seeking care for chronic pain (Mills et al., 2019).

Sex Assigned at Birth

Pain can be perceived differently between males and females. When discussing the impact of biological sex on pain, it is important to differentiate between biological sex and gender. Biological sex refers to the assignment of male, female, or Intersex at birth based on different genitalia and chromosomes. Gender refers to the characteristics of male or female based on social and cultural norms. A person may be assigned a biological sex that does not align with their gender. For example, a person may have sex characteristics of a male, but identify socially and culturally as a female. Both biological sex and gender can play a role in pain.

Research has shown that males are less likely to express pain and seek treatment for pain than females (Mills et al., 2019). People assigned female at birth may also experience pain that males do not, such as menstrual pain and labor pain.

Females experiencing pain are often more likely to be undertreated than males (Casale et al., 2021). The understanding of pain related to specific female health conditions has historically been misunderstood. Many researchers are advocating for development of pain medication specifically designed for females (Casale et al., 2021). Research shows that females are affected by pain more severely and more frequently than males (Casale et al., 2021). Recent research shows that there are significant differences in the physiologic mechanisms of pain related to sex. Females perceive pain differently than males do and hormones can affect pain signals (Osborne & Davis, 2022). Recent research has been more inclusive of females, but there is still more needed. Because of the lack of inclusion of females in studying the effects of pain, many feel misunderstood when seeking pain management from healthcare providers. It is important for nurses to understand how sex and gender can impact patients' perception of pain and that more research is needed to determine the extent of its effect.

Psychological Factors Affecting Pain

A patient's expectations of pain can often increase or decrease the severity. If a patient believes they will have a lot of pain, their perception can increase. In contrast, if a patient believes an intervention will be effective, their pain may decrease (Heshmat, 2023). The interpretation of pain can also have an impact on pain perception. How pain affects a patient's quality of life can change their perception of pain. For example, a patient who is having pain from an elective surgery may perceive their pain differently than a patient who is having chronic pain from cancer treatment does.

PATIENT CONVERSATIONS

What If Your Patient Believes Nothing Will Work to Treat Their Pain?

Scenario: The nurse is caring for a patient who is experiencing chronic pain from cancer treatment. The patient is exhibiting signs of withdrawal and depression and looks worried when the nurse walks into the room.

Nurse: Hi, my name is Emily, and I am going to be your nurse today. Do you mind verifying your name and birthday for me?

Patient: Sure, Alice Wilde 12/13/1960.

Nurse: Nice to meet you, Alice. Are you experiencing any pain right now?

Patient: Yes, I am always in pain. I don't think it's ever going to go away.

Nurse: What would you rate your pain on a scale of zero to ten, with zero being no pain and ten being the worst pain?

Patient: A seven. It's always a seven. You all ask me the same questions every day. My pain is in my abdomen, and it feels dull and achy. I never get any relief from it even though they have me on all these medications that make me so sleepy.

Nurse: I am sorry to hear that. Have you tried anything besides the medications for your pain?

Patient: Why bother? I know it won't get any better. I have pain because I have cancer. Everyone I know who has had cancer was in so much pain all the time, so I know it will be that way for me.

Nurse: Sometimes having a positive mindset can make a big difference in your pain. I know that can be hard to do, but maybe we could try a few techniques to see if it will help?

Patient: I guess, although I really do not think anything will help my pain. The doctors tell me I'm on the maximum dose of medications and nothing is helping.

Nurse: I understand it can be frustrating that the interventions are not helping your pain. Why don't we try looking at your pain a different way?

Patient: What do you mean?

Nurse: Sometimes, you experience pain when you expect it. So, if you think your pain will always be a seven, then that is what it will feel like. If you can change your mindset to a more positive outlook for your pain, you may find your pain decreasing.

Patient: I have never thought about it that way. I am willing to give that a try.

Experience

Past experience of pain can impact how a patient perceives pain in the present or future. Pain can be a learned behavior (Cosio, 2020). Children who see their parents in chronic pain may assume that all adults experience pain. Children learn to express pain by watching others. For example, a child who stubs their toe may yell a profanity and grab their toe because they saw their father do the same thing. Patients also learn what pain interventions are effective, even if they can have negative consequences. For example, a patient may realize that lying on the couch relieves their back pain. However, prolonged inactivity can lead to chronic pain and more adverse effects (Cosio,

2020).

Expectation

The perception of pain can be shaped by expectations. If a patient believes they will have a lot of pain, their perception can increase. Patients may catastrophize and assume the worst possible outcome for their pain. This can cause the patient to feel worse pain and add negative emotions, such as fear and anxiety, to their pain (Heshmat, 2023).

Patients can also improve their pain with appropriate expectations. If the patient expects an intervention to work, they may experience decreased pain (Heshmat, 2023). This is called a placebo effect. A **placebo effect** is when a certain treatment proves to be an effective pain reliever due to the patient believing it will be effective (Cosio, 2020). Nurses can educate patients on the importance of appropriate expectations when managing their pain to improve patient outcomes.

Interpretation

Patients all have different interpretations of pain. Because pain is a subjective experience, it is important for nurses to accept the pain for whatever the patient says it is. Some patients may interpret pain as debilitating whereas another patient may interpret the same pain as mild (Heshmat, 2023). A patient may interpret ankle pain as "dull and achy" whereas another patient may interpret ankle pain as "sharp and stabbing." Situational awareness can also impact a patient's interpretation of pain. For example, a patient who is having their first child may interpret pain as a joyful sign of new life and welcome the pain. Another patient who is in hospice care for chronic pain may interpret pain as a sign that death is imminent. It is important for nurses to remember that all patient interpretations of pain are correct and to be mindful of how a patient interprets their pain when providing pain interventions.

Avoidance

Some patients may choose to deal with pain by avoiding it. Patients may refuse to discuss their pain or may not disclose pain at all. Patients who are unable to cope with their pain may be more likely to ignore it (Cosio, 2020). It is natural for a person to run away from pain so patients should be aware that this is an understandable reaction to pain (Fournier, 2020). However, patients need to understand that avoiding pain does not make it better or go away. Sometimes avoiding pain can make it worse. Pain can also be a sign of further health complications and ignoring it can lead to negative outcomes. For example, a patient experiencing chronic migraines may ignore the pain because they do not want to seem like a burden on their family. However, the pain could be a sign of a more serious issue such as a brain tumor. Ignoring the pain could lead to the patient delaying diagnosis and treatment of a more serious issue.

16.4 Pain Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe how to collect subjective data for a pain assessment
- Identify how to collect objective data for a pain assessment
- Recognize how to document a pain assessment

Pain is a subjective experience, which means it cannot always be observed externally. Because patients do not always outwardly display signs of pain, the pain assessment must be multidimensional (Wideman et al., 2019). Both subjective and objective data need to be included in a comprehensive pain assessment to get a complete picture of the patient's pain.

Using a variety of assessment tools allows the patient to express the quality, type, and intensity of the pain. The nurse may use a pain rating scale and different types of questions to collect subjective data. Objective data can be collected by performing a physical assessment, measuring vital signs, and observing patient behaviors such as posture and facial expressions.

A comprehensive pain assessment is the key to adequately treating pain and is a crucial nursing skill. Without comprehensive baseline data, it can be difficult to provide effective pain management for patients.

Collecting Subjective Data

Because pain is a subjective experience, most of the collected data will be subjective (Wideman et al., 2019). Information obtained from the patient and/or family members and offers important cues from their perspective is called subjective data. A comprehensive pain assessment includes questions that assess the quality, region, severity, potential cause, timing, and aggravating and relieving factors of the patient's pain. Asking the patient open-ended questions allows them to elaborate on their pain and helps the nurse fully understand the patient's concerns.

The PQRSTU mnemonic is often used to remember these subjective assessment questions:

- Provocation/Palliation: What makes your pain feel worse or better?
- Quality: What does the pain feel like?
- Region: Where exactly do you feel the pain? Does it radiate?
- Severity: How would you rate your pain on scale of 0 to 10?
- Timing/Treatment: When did the pain start? How long does the pain last? Have you taken anything to relieve the pain?
- Understanding: What do you think is causing the pain?

These pain assessment questions help the nurse establish a baseline assessment of the patient's pain.

PATIENT CONVERSATIONS

A Comprehensive Pain Assessment Using the PQRSTU Questions

Scenario: The nurse is caring for a patient who has come into the emergency department. The nurse begins asking the patient questions about their pain including follow-up questions using PQRSTU assessment.

Nurse: Hi, my name is Sulee, and I am going to be your nurse today. What brings you in today?

Patient: My lower back is killing me. I am in so much pain.

Nurse: I am sorry to hear that. I am going to ask a few more questions about your pain so we can get an idea of what is causing it and how we can help alleviate your pain. What makes your pain worse?

Patient: Sometimes it gets worse if I am sitting for a long time.

Nurse: Do you have to sit for a long period of time often?

Patient: Yes, I sit at a desk all day at work. My back always hurts when I get home.

Nurse: What does the pain feel like?

Patient: It starts feeling sore and aching, but by the end of the day it feels like a knife is stabbing me in the back.

Nurse: Where do you feel the pain in your back?

Patient: In my lower back.

Nurse: Does the pain radiate to somewhere else in your back or in your body?

Patient: No, the pain is just across my lower back.

Nurse: How would you rate your pain on a scale of zero to ten with zero being no pain and ten being the worst pain?

Patient: Probably a seven.

Nurse: Would you rate your pain differently after sitting for a long period of time?

Patient: Yes, it's a nine when I get home from work.

Nurse: Is the pain constant or does it come and go?

Patient: The aching is constant, but the stabbing feeling comes and goes.

Nurse: Have you taken any medication to relieve the pain?

Patient: I take ibuprofen daily and sometimes I try to lie down after work.

Nurse: Does the ibuprofen and lying down relieve the pain?

Patient: Sometimes it makes it better, but the pain never goes away.

Nurse: What do you think is causing the pain?

Patient: I was in a car accident last year and my back has hurt me ever since.

Nurse: Thank you for sharing that information. I am going to do a few other assessments so I can better understand your pain and how we can help you.

Collecting subjective data allows the nurse to begin to understand the type and location of the patient's pain. In addition to the PQRSTU mnemonic, there are many different pain rating scales the nurse can use depending on the patient's cognitive and developmental level.

Numeric Rating Scale

Asking a patient to use a numeric rating scale to rate the severity of their pain from 0 to 10, with "0" being no pain and "10" being the worst pain imaginable, is a common way to assess patients for pain. Most patients find the numeric rating scale easy to use and healthcare providers find the results easy to interpret (Zambon, 2020). However, the numeric rating scale may not be appropriate for all patients. Factors such as age, native language, literacy level, and cognitive ability may prohibit patients from understanding the numeric rating scale (Zambon, 2020). Some patients may be too young or cognitively delayed, or even sedated to understand how the numbers relate to the severity of pain. Patients from various cultures and native languages may not understand the numbers on the scale and may prefer a more visual pain rating scale. The nurse must ensure the patient can understand the numeric rating scale before using it. If the patient does not understand, a different assessment tool must be used.

When using a numeric rating scale, the nurse should always accept the patient's pain for what they say it is (Wideman et al., 2019). For example, one patient with a sprained ankle may rate their pain as a 4 out of 10, while another patient with a sprained ankle may rate their pain as an 8 out of 10. Both patients are right as their interpretation of pain is subjective (Dydyk & Grandhe, 2023).

The numeric rating scale provides the nurse with the severity of a patient's pain but does not provide any other information (Wideman et al., 2019). Additional questions must be asked to obtain a thorough pain assessment and to assess the patient's comfort-function goal. The comfort-function goal is an individualized patient goal identifying their acceptable pain tolerance while maintaining their daily functions. This goal provides the basis for the patient's individualized pain treatment plan and is used to evaluate the effectiveness of interventions. Each patient's comfort-function goal will be different. For example, one patient may have a comfort-function goal of 4 out of 10 pain severity while another patient may have a goal of 0 out of 10 pain severity.

The numeric rating scale is the most common pain rating scale used in nursing due to its simplicity and ease of understanding. However, it is important for nurses to know other pain rating options to best suit individual patient needs.

Wong-Baker FACES Pain Rating Scale

The **Wong-Baker FACES Pain Rating Scale** is a visual tool used to evaluate pain severity. The scale uses drawings of different faces exhibiting increasing levels of pain and was created in 1983 by two pediatric healthcare workers, Donna Wong and Connie Baker, to help children express their pain. Today, the scale can be used for anyone age three and older to visually represent their pain level (Wong-Baker FACES Foundation, 2023).

LINK TO LEARNING

The Wong-Baker FACES Pain Rating Scale (https://openstax.org/r/77WongBaker) can be used for a variety of patients including children, patients of diverse cultures and native languages, and patients who are nonverbal due to

its simplistic illustrations.

To use this scale, use the following evidence-based instructions. Explain to the patient that each face represents a person who has no pain (hurt), some pain, or a lot of pain. "Face 0 doesn't hurt at all. Face 2 hurts just a little. Face 4 hurts a little more. Face 6 hurts even more. Face 8 hurts a whole lot. Face 10 hurts as much as you can imagine, although you don't have to be crying to have this worst pain." Ask the patient to choose the face that best represents the pain they are feeling.

Even though this pain rating scale was intended for children, research shows that many adult patients may prefer a visual scale. Patients with different native languages or patients who are cognitively delayed may have an easier time understanding a visual scale compared to a numeric rating scale.

McCaffrey Initial Pain Assessment Tool

The **McCaffrey Initial Pain Assessment Tool** is another assessment tool that helps patients express their pain. The McCaffrey Initial Pain Assessment Tool uses visual aids and questions including elements of the PQRSTU mnemonic to provide a comprehensive pain assessment. The McCaffrey tool provides a more comprehensive picture of a patient's pain than the numeric rating scale or the Wong-Baker FACES scale.

The McCaffrey pain assessment tool includes questions pertaining to the severity, causes, contributing factors, and effects of pain. Images of the human body are included to help patients identify the exact location of their pain. There are detailed questions to help patients express the effects of pain such as accompanying emotions or symptoms, decreased quality of life, decreased physical activity, and poor sleep.

Collecting Objective Data

Collecting objective data is the second half of a comprehensive pain assessment. Objective data include things that the nurse can measure, such as vital signs and patient behavior. Objective data can help the nurse understand the patient's pain rating and corroborate the subjective assessment data (Xu & Huang, 2020).

An objective pain assessment includes measuring vital signs, physical assessment, and observing for nonverbal indicators of pain, such as grimacing or moaning. It is especially important to observe for nonverbal indicators of pain in patients unable to self-report their pain, such as infants, children, patients who have a cognitive disorder, patients at end of life, patients who are non-English speaking, or patients who tend to be stoic due to cultural beliefs.

Nurses should be aware that pain can be exhibited through physical symptoms and patient behaviors. A pain assessment should be performed by the nurse prior to any patient interventions to determine if physical assessment findings are related to pain or something else. For example, a patient appears hunched over and guarding their stomach with reports of nausea and lack of appetite. The nurse should recognize that these symptoms could be physical signs of pain and perform a comprehensive pain assessment as the initial intervention.

Collecting objective data allows the nurse to corroborate the subjective assessment of a patient's pain. An objective pain assessment is especially important if the patient is unable to answer questions about their pain.

Physical Assessment

A physical assessment is crucial to develop a pain treatment plan. Assessment of the location of the patient's pain can give the nurse context to the potential cause of pain. The nurse should inspect the site of pain for any abnormalities such as swelling, lacerations, or discoloration. Areas of pain can be identified by palpating for any tenderness, swelling, or change in temperature. The nurse should note if the patient is guarding any body part as this could indicate the location of pain. Symptoms such as diaphoresis, nausea, vomiting, or lack of appetite can often be the result of pain. For example, a patient reports moderate pain on their upper back. Upon examining the patient's back, the nurse finds bruising and tenderness upon palpation on the patient's right shoulder. The physical assessment helps the nurse pinpoint a specific location of pain, which can help guide pain management.

Decreased daily activity can be another result of pain, especially if the patient is experiencing chronic unmanaged pain. Assessing the effect pain has on a patient's ability to bathe, dress, prepare food, eat, walk, and complete other daily activities is a new standard of care that assists the interdisciplinary team in tailoring treatment goals and interventions that are customized to the patient's situation. For example, for some patients, chronic pain affects

their ability to be employed, so effective pain management is vital so they can return to work. For other patients receiving palliative care, the ability to sit up and eat a meal with loved ones without pain is an important goal.

CLINICAL JUDGMENT MEASUREMENT MODEL

Recognize Cues: Identifying Physical Pain Assessment Data

The nurse is performing an initial assessment on a school-aged patient who has arrived to the hospital after being hit with a baseball. The nurse observes that the patient is guarding their right leg and is grimacing while sitting in the bed. The nurse inspects the patient's right leg and identifies discoloration and swelling. The nurse observes the right leg is positioned at an odd angle and the patient cries out upon palpation. The patient is unable to move their leg and states "It hurts even more when I try to move." The nurse recognizes that the odd angle and decreased mobility of the patient's leg is most concerning. The nurse recognizes that further evaluation is needed to determine appropriate interventions for the patient's pain.

Observe Expression and Posture

Nonverbal pain cues are an important part of an objective pain assessment. Expression and posture can indicate that a patient is in pain. Facial expressions such as grimacing, moaning, clenched teeth, or crying are ways for patients to express pain. Abnormal posture such as hunching over, contracting, rigidity, limited movement, or abnormal gait could also indicate that the patient is in pain (Figure 16.8).

FIGURE 16.8 A patient can exhibit physical signs of pain such as poor posture and guarding. (credit: "day 045" by Holly Lay/Flickr, CC BY 2.0)

Abnormal posture does not always indicate pain. A patient may have a stooped posture due to certain conditions, such as scoliosis or arthritis, and report no pain. The nurse should ask the patient if the abnormal posture is normal for them and always initiate a pain assessment.

Patients often exhibit abnormal posture and abnormal facial expressions together when experiencing pain. For example, a patient may exhibit a hunched posture but appear calm and relaxed and report no pain. Another patient may exhibit a hunched posture accompanied by moaning and crying. This could indicate that this is not a normal

posture for the patient and may be related to pain.

When assessing patients with abnormal posture or facial expressions, the nurse should recognize that they could be potential nonverbal pain cues. Sometimes patients are in too much pain to speak or may be unable to verbally communicate. Nonverbal indicators of pain such as abnormal posture and facial expressions can be helpful to the nurse when collecting objective pain assessment data.

Inspect Skin, Muscles, and Joints

Performing an assessment of the skin, muscles, and joints can help the nurse identify specific areas of pain. Changes in skin, decreased range of motion, and an abnormal gait can all be indicative of pain. Through subjective data collection, the nurse can identify the general location of the patient's pain. Then the nurse can assess the skin, muscles, and joints in that area to provide more data to the pain assessment.

The nurse should inspect the skin for any abnormalities such as swelling, lacerations, skin breakdown, drainage, and discoloration. Areas of pain can be identified by palpating for any tenderness, swelling, or change in temperature.

Abnormal gait, decreased range of motion, and decreased muscle strength can all be signs of pain. Just like when assessing posture and facial expressions, it is important for the nurse to remember that abnormalities in the skin, muscles, and joints do not always indicate pain. The nurse should pay particular attention to what the patient is reporting about current symptoms, as well as history of any issues. Information should be compared to expectations for the patient's age group or that patient's baseline. For example, an older patient may have chronic limited range of motion in the knee due to osteoarthritis, whereas a child may have new, limited range of motion due to a knee sprain that occurred during a sports activity.

Changes in skin, muscles, and joints are not always present with pain. However, these assessments can help the nurse identify a specific location of pain or potential aggravating factors.

Measure Vital Signs

Abnormal vital signs can be another nonverbal indicator of pain, especially when patients cannot show behavioral signs of pain (Ford, 2019). For example, a patient who is sedated and intubated cannot answer questions about their pain or exhibit any behaviors indicating pain. The nurse can measure vital signs along with other physical symptoms to assess pain.

Pain can cause hypertension, tachycardia, or tachypnea. Respiratory distress such as loud breathing, nasal flaring, or the use of accessory muscles can also indicate pain. Just like other nonverbal pain indicators, abnormal vital signs can also be present in the absence of pain. The nurse must use other assessment tools in addition to measuring vital signs to determine if the vital signs are related to pain (Ford, 2019).

In 1995, the American Pain Society introduced the concept of pain as the fifth vital sign to encourage providers to assess pain more frequently and prioritize pain assessments in patient care (Scher et al., 2017). There is ongoing debate as to whether treating pain as the fifth vital sign has contributed to the ongoing opioid crisis in America. Some providers believe that putting an intense focus on pain management can lead to the overprescribing of opioids, but other providers believe that pain management should be the priority in patient care. Current research shows that pain is an ongoing patient concern, and that consistent, multidimensional pain assessments are most effective in managing pain (Scher et al., 2017).

Nurses must always make pain a top priority of patient care. Nurses must include multiple assessment tools, such as measuring vital signs, in their pain assessments and individualize their assessments to meet each patient's needs.

Assess Behavioral Cues

Behavioral cues can be important indicators of pain if the patient is unable to answer subjective assessment questions. The nurse may notice a flat affect in a patient in pain. Affect refers to the outward display of one's emotional state. For example, a patient with a "flat affect" refers to very few facial expressions being displayed to indicate emotion (Figure 16.9).

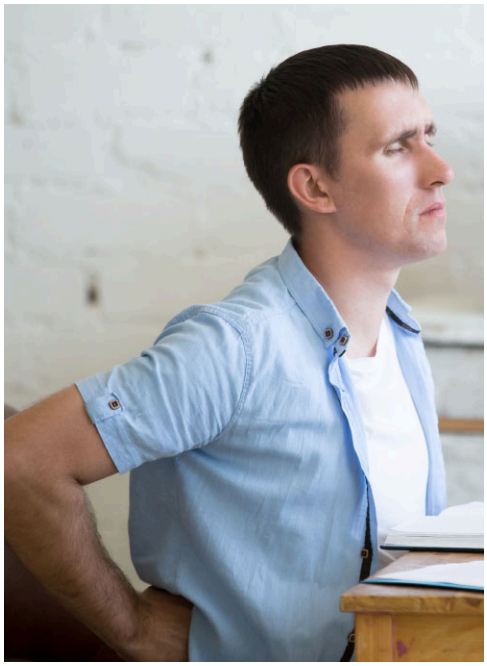

FIGURE 16.9 Patients with flat affects are often associated with depression or anger, but they can also be behavioral cues of pain. (credit: "young office man suffering from backache" by centro güel/Flickr, CC BY 2.0)

The nurse must recognize that not every patient in pain will have the same behavioral cues. For example, one patient in pain may appear quiet and withdrawn while another patient may appear very angry and aggressive. A patient's behavioral cues may not always match their subjective pain assessment. This is often the case with patients in chronic pain. For example, a patient who has cancer may rate their pain an 8 out of 10 while calmly eating lunch with their family. It is important for the nurse to remember that pain is whatever the patient says it is and that behavioral cues are only one aspect of the comprehensive pain assessment.

Documenting Pain Assessment

Documentation of the pain assessment, interventions, and reevaluation are key to effective, individualized pain management. Pain assessments should occur at regular intervals and a reassessment of pain should occur after any interventions (The Joint Commission, 2020).

When documenting subjective data, it should be in quotation marks and start with wording such as, "The patient reports..." or "The patient's wife states ...". The nurse should document any subjective data stated by the patient including their pain score, what pain rating scale was used, and any follow-up information. The nurse should also document any behaviors, facial expressions, or physical attributes that could be related to pain. For example, the nurse would document "Patient states pain is a 7 out of 10 using the numeric rating scale. Patient is crying and grimacing. Patient states pain is in their right shoulder and has been ongoing for two days. Patient states heat relieves the pain for short periods of time. Patient's right shoulder does not appear to have any skin breakdown or discoloration. Patient has decreased range of motion in their right shoulder when compared to the left shoulder."

The nurse should also document the patient's comfort-function goal and any communication with other healthcare providers. Documenting a pain assessment notifies the patient's entire healthcare team of the assessment data. This allows the healthcare team to begin to plan interventions and further evaluation if needed. The team cannot initiate pain interventions without good assessment documentation, so this should be a top priority for the nurse.

Documenting Treatment

All pain management interventions need to be documented according to the policy of each healthcare facility. Pain management interventions can be pharmacological or nonpharmacological. Nonpharmacological treatments can include exercise, mind-body practices, psychological therapy, heat or cold, braces, and rehabilitation (Agency for Healthcare Research and Quality [AHRQ], 2019).

Any administered pain medication should be documented in the patient's electronic medication administration

record (eMAR). It is important to immediately document the intervention to avoid potential errors such as an unintended repeat dose of medication. Nonpharmacological treatments should also be documented in the patient's medical record. Documentation of all pain interventions ensures all providers are aware of pain management strategies and that the patient is getting timely and effective treatment.

Documenting Evaluation of Treatment

All pain management interventions need to be evaluated and documented to ensure they are effective. It is important to perform a follow-up assessment in the appropriate time frame. The nurse should be aware of the different mechanisms of action for different forms of pain medications to best evaluate the effectiveness. For example, administration of intravenous pain medication should be evaluated within a shorter time frame than oral pain medication due to the different durations of action. The Joint Commission guidelines state that healthcare facilities should have policies in place regarding timeliness of pain reassessments and evaluation (The Joint Commission, 2020).

The nurse should document a new pain level and any symptoms of pain following any interventions. For example, if a patient reported a pain level of 8 out of 10 before PRN pain medication was administered, the nurse evaluates the patient's pain level after administration to ensure the pain level is decreasing and the pain medication was effective. Effective pain management involves mutual pain goals between the healthcare team and the patient and ongoing reassessment with the patient to assess the effectiveness of pain interventions (ANA Center for Ethics and Human Rights, 2018). The nurse should compare the current pain rating to the patient's stated comfort-function goal. If the patient states that their pain does not meet their comfort-function goal, the nurse should continue to explore pain management strategies and continue to reevaluate.

16.5 Pain Management

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe pharmacological therapy in pain management
- Identify nonpharmacological therapy in pain management
- Recognize how patient-controlled analgesia (PCA) is used for pain management

Nurses have a responsibility to provide multimodal pain management (ANA Center for Ethics and Human Rights, 2018). Pain management should include different interventions and focus on helping patients improve their quality of life (National Center for Injury Prevention and Control, 2022).

Pain management requires collaboration with the entire interdisciplinary team. Involving specialists such as neurologists, surgeons, and physical therapists can help manage patients' pain (Dydyk & Grandhe, 2023). Pain can be managed by pharmacological and nonpharmacological therapy. The most effective pain management uses a combination of pharmacological and nonpharmacological interventions.

Pharmacological Therapy

A type of therapy called **pharmacological therapy** can be very effective in treating pain. Pharmacological therapy is the use of medication to treat a disease, illness, or medical condition. The type of medication depends on the type, duration, and severity of the pain (Ford, 2019). There are three main types of pain medications: opioid analgesics, nonopioid analgesics, and adjuvants. An **analgesic** is a medication used to relieve pain. When administering pain medications, the nurse must consider the patient's goals for pain relief and determine if past medications have been effective. The nurse must also consider if the patient is experiencing any side effects that may impact the patient and be aware of contraindications (AHRQ, 2019). Patients should be involved and engaged in their pain management plan. Research has shown improved patient outcomes when patients work together with the healthcare team to manage their pain.

Opioid Analgesics

An **opioid analgesic** is a powerful prescription medication that helps reduce pain by blocking pain signals. Common opioids include codeine, morphine, fentanyl, oxycodone, and tramadol. Different opioids have different amounts of analgesia, ranging from codeine used to treat mild to moderate pain, up to morphine, used to treat severe pain (Table 16.2). Opioids are commonly administered orally or intravenously, but can also be administered rectally,

subcutaneously, intramuscularly, or through the skin.

Generic Name	Trade Name(s)	Route	Adult Dosages
Codeine with acetaminophen	Tylenol #3	PO	30 mg/300 mg
Hydrocodone with acetaminophen	Lortab, Norco, Vicodin	PO	5 mg/300 mg or 325 mg 10 mg/320 mg or 325 mg 5 mg/500 mg
Oxycodone (immediate release and extended release) or Oxycodone with acetaminophen	Oxycodone (IR), OxyContin (ER) Percocet, Roxicet	PO PO	5–10 mg 5 mg/325 mg
Fentanyl	Duragesic, Sublimaze	Transdermal IM IV	12–100 mcg/hr 0.5–1 mcg/kg 0.5–1 mcg/kg
Hydromorphone	Dilaudid	PO Rectal SubQ, IM, and IV	4–8 mg 3 mg 1.5 mg (may be increased)
Morphine	Duramorph, MS Contin, Oramorph SR, Roxanol	PO and rectal SubQ, IM, and IV	30 mg (may be increased) 4–10 mg (may be increased)

TABLE 16.2 Common Opioid Analgesics

Opioids have a high risk of addiction and overdose, so it is important to consider other forms of pain management before prescribing opioids (National Center for Injury Prevention and Control, 2022). The Centers for Disease Control and Prevention (CDC) recommends avoiding opioids for pain management in patients younger than 18 years old and to avoid opioids as **first line therapy** for chronic pain (Dowell et al., 2022). First line therapy is medical treatment that is recommended as the best option for the initial treatment of a disease or medical condition.

It is important that patients are informed about the side effects and risks of opioids. Side effects of opioids include the following:

- addiction
- confusion
- constipation
- drowsiness
- itching
- nausea and vomiting
- overdose
- physical dependence
- respiratory depression
- tolerance

Constipation, nausea, and vomiting are common side effects of opioids. Opioids slow peristalsis and cause increased reabsorption of fluid into the large intestine, resulting in slow-moving, hard stools. Nurses should educate patients on preventing constipation with a bowel management program including stool softeners, fluids, well-

balanced diet, and physical activity (as allowed with pain/postsurgical restrictions) to aid in preventing constipation. Because opioids slow gastrointestinal mobility, nausea and vomiting can also occur when taking opioids. Typically, patients will build enough tolerance against nausea and vomiting after taking opioids for a few days. Respiratory depression is one of the most serious potential side effects of opioids. Nurses must closely monitor patients receiving opioids for respiratory depression and administer naloxone to reverse the opioid effects if needed.

As important as pain management is, it is also crucial that healthcare providers are mindful of prescribing opioids to treat pain due to the high risk of addiction and overdose. Addiction is a chronic disease of the brain pursing reward and/or relief by substance use. Patients suffering from addiction have trouble stopping the use of opioids and often struggle with addiction for the rest of their life. Patients can also struggle with **tolerance** and **physical dependence** with opioid misuse. Tolerance is when the body builds up resistance to a medication. Physical dependence is when the patient experiences physical symptoms of withdrawal, such as anxiety, diaphoresis, and muscle cramps, when stopping a medication (National Center for Injury Prevention and Control, 2022).

Healthcare providers must be vigilant to avoid addiction and overdose with opioid use especially with the current opioid epidemic in the United States. Opioids can be very effective in pain management when used appropriately, but healthcare providers must monitor for serious side effects (ANA Center for Ethics and Human Rights, 2018).

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety: Opioid Analgesic Administration

Disclaimer: Always follow the facility policy for medication administration.

Definition: Minimize risk of harm to patients and providers through both system effectiveness and individual performance.

Knowledge: Examine human factors and other basic safety design principles as well as commonly used unsafe practices.

Skill: Demonstrate effective use of strategies to reduce risk of harm to self or others. The nurse will:

- Avoid distractions and disruptions when preparing and administering medications.
- Have a second nurse witness any wasted opioid medication and document the wasted amount.
- Perform hand hygiene before administering medications.
- Perform a comprehensive pain assessment on the patient prior to medication administration.
- Verify the patient's information prior to medication administration.
- Monitor for adverse effects after medication administration.
- Perform a comprehensive pain assessment after medication administration to assess effectiveness.

Attitude: Value the contributions of standardization and reliability to safety.

Nonopioid Analgesics

Nonopioid analgesics are another effective form of pain management. A **nonopioid analgesic** is a type of medication that includes **nonsteroidal anti-inflammatory drugs (NSAIDs)** used for acute and chronic pain relief. Other nonopioid analgesics include acetaminophen, anticonvulsants, lidocaine, tricyclic and tetracyclic antidepressants, and serotonin and norepinephrine reuptake inhibitor (SNRI) antidepressants (National Center for Injury Prevention and Control, 2023). Acetaminophen is used to treat mild pain and fever but does not have anti-inflammatory properties. Acetaminophen is often administered orally but can be administered rectally or intravenously. There is a risk of severe liver damage when taking too much acetaminophen or consuming a large amount of alcohol while taking acetaminophen. Nonopioid analgesics have high risks in certain patient populations such as older adults, pregnancy, and patients with liver, cardiovascular, kidney, and gastrointestinal disease (National Center for Injury Prevention and Control, 2023). It is important for nurses to educate these patient populations about the side effects of nonopioid analgesics and the importance of limiting the amount consumed.

NSAIDs provide mild to moderate pain relief while also reducing fever and inflammation by inhibiting the production of prostaglandins. NSAIDs can be used along with opioids for severe pain. Common NSAIDs include ibuprofen,

naproxen, ketorolac, and aspirin (Table 16.3). Ibuprofen and naproxen are commonly prescribed NSAIDs and can be taken several times a day. Ketorolac can help treat breakthrough pain and is indicated for short-term management of moderate to severe acute pain. Common side effects of NSAIDs include nausea and vomiting, gastrointestinal bleeding, and kidney failure. There is an increased risk of heart attack, heart failure, and stroke if patients take more NSAIDs than prescribed or longer than directed.

Drug Name	Administration Considerations	Adverse/Side Effects
Ibuprofen	• Given parenterally and orally • Assess pain prior to and after administration • May take with food or milk if stomach upset occurs • Stay well hydrated to prevent kidney failure • Assess patient for signs of GI bleed • Assess for skin rash • Monitor BUN, serum creatinine, CBC, and liver function test • Do not administer to patients who are allergic to aspirin or other NSAIDs	• Headache • GI bleed • Constipation • Dyspepsia • Nausea • Vomiting • Steven-Johnson syndrome • Kidney failure
Aspirin	• Given orally • Assess pain prior to and after administration • Children under 12 years: do not use unless directed by a provider • Take with a full glass of water and sit upright for fifteen to thirty minutes after administration • Take with food if the patient reports that aspirin upsets their stomach • Do not crush, chew, break, or open an enteric-coated or delayed-release pill; it should be swallowed whole • The chewable tablet form must be chewed before swallowing • Should be stopped seven days prior to surgery due to the risk of postoperative bleeding	• GI upset • GI bleeding • Tinnitus

TABLE 16.3 Commonly Used NSAIDs

Drug Name	Administration Considerations	Adverse/Side Effects
Ketorolac	• Given orally, parenterally and as an ophthalmic solution • Assess pain prior to and after administration • Therapy should always be given initially by the IM or IV route; then use the oral route as a continuation of parenteral therapy • Stay well hydrated to prevent kidney failure • Assess patient for signs of GI bleed • Assess for skin rash • Monitor BUN, serum creatinine, CBC, and liver function tests • Do not administer before any major surgery • Do not administer to patients who are allergic to aspirin or other NSAIDs	• Drowsiness • Headache • GI bleed • Abnormal taste • Dyspepsia • Nausea • Steven-Johnson syndrome • Edema • Kidney failure
Naproxen	• Given orally • Assess pain prior to and after administration • May take with food or milk if stomach upset occurs • Stay well hydrated to prevent kidney failure • Assess patient for signs of GI bleed • Assess for skin rash • Monitor BUN, serum creatinine, CBC, and liver function test • Do not crush, chew, or split open a delayed-release pill; it should be swallowed whole • Do not administer to patients who are allergic to aspirin or other NSAIDs	• Headache • GI bleed • Constipation • Dyspepsia • Nausea • Vomiting • Steven-Johnson syndrome • Tinnitus • Kidney failure

TABLE 16.3 Commonly Used NSAIDs

Adjuvant Analgesics

An **adjuvant analgesic** is a type of medication that is not classified as an analgesic but has been found to have an analgesic effect along with opioids (Table 16.4). Adjuvant medications include antidepressants and anticonvulsants such as gabapentin and amitriptyline. Adjuvant analgesics can be very effective for neuropathic pain but may not be as effective for somatic or visceral pain (Jacques, 2022).

Drug Name	Administration Considerations	Adjuvant Effect	Adverse/Side Effects
Amitriptyline	• Boxed warning: Increased risk of suicidality • Taper dose when discontinuing; do not stop abruptly • Monitor orthostatic blood pressures and consider fall risk precautions	Decrease feelings of chronic pain	• Immediately report signs or symptoms of suicidality • Anticholinergic effects • Hypotension • May lengthen QT interval; risk for arrhythmias • Sedation • Sexual dysfunction • Altered seizure threshold
Gabapentin	• Administer first dose at bedtime to decrease dizziness and drowsiness • Monitor for worsening depression, suicidal thoughts or behavior, and/or any unusual changes in mood or behavior • Taper dose; do not stop abruptly	Decreased neuropathic pain	• Increased suicidal ideation • Immediately report fever, rash, and/or lymphadenopathy • CNS depression: dizziness, somnolence, and ataxia

TABLE 16.4 Commonly Used Adjuvant Analgesics

Drug Name	Administration Considerations	Adjuvant Effect	Adverse/Side Effects
Prednisone	• Never abruptly stop corticosteroid therapy • Use the lowest dose possible to control disorder and taper when feasible • May require concurrent treatment for osteoporosis or elevated blood glucose levels • Regularly monitor for development of symptoms of adrenal suppression • Contraindicated in patients with untreated systemic infections	Reduce inflammation	• Fluid and electrolyte imbalances • Increase in blood glucose • Muscle weakness • Peptic ulcers • Thin, fragile skin that bruises easily • Poor wound healing • Development of Cushing syndrome • May mask some signs of infection, and new infections may appear • Psychic derangements may appear when corticosteroids are used, ranging from euphoria, insomnia, mood swings, personality changes to severe depression

TABLE 16.4 Commonly Used Adjuvant Analgesics

Drug Name	Administration Considerations	Adjuvant Effect	Adverse/Side Effects
Baclofen	• Given parenterally and orally • Administer orally with milk or food to minimize gastric upset • Assess for muscle spasticity before and during therapy • Observe patient for drowsiness • For intrathecal administration, monitor patient closely during test dose and titration and have resuscitative equipment available	Relieve muscle spasms and spasticity	• Drowsiness • Confusion • Dizziness or lightheadedness • Nausea • Constipation • Muscle weakness
Lidocaine topical	• Given topically on the skin; can be in the form of a cream, ointment, or patch • Patches should not be worn for more than twelve hours in a twenty-four-hour period	Relieve local pain	• Headache • Vomiting • Irritation at site • Numbness • Sudden dizziness or drowsiness • Confusion • Speech or vision problems • Tinnitus • Severe allergic reaction, such as hives, dyspnea, and angioedema of the face, lips, tongue, or throat

TABLE 16.4 Commonly Used Adjuvant Analgesics

Antidepressants can help control how pain signals are delivered to and processed by the brain. Amitriptyline is a tricyclic antidepressant that can help treat neuropathic pain. Amitriptyline can cause sedative effects, so it is usually administered at bedtime. Anticonvulsants can block certain types of pain signals and help decrease neuropathic pain (Jacques, 2022). Gabapentin is an anticonvulsant that can also treat neuropathic pain and restless leg syndrome. Side effects of gabapentin include mental health changes, drowsiness, and weakness.

Other medications such as corticosteroids, muscle relaxants, and topical agents can also help reduce pain. Corticosteroids decrease inflammation and topical agents can be directly applied to the skin to decrease pain (Jacques, 2022). Adjuvant analgesics can help reduce pain in a variety of ways but are not always effective on their own.

Nonpharmacological Therapy

A type of therapy called **nonpharmacological therapy** can be very effective when used in conjunction with pharmacological therapy. The Joint Commission recommends that healthcare providers use at least one

nonpharmacological pain intervention when creating a pain treatment plan (The Joint Commission, 2020). Nonpharmacological therapy is any intervention that helps reduce pain without using medication. Nonpharmacological therapy can include psychological, emotional, and environmental therapies.

Psychological and emotional therapies can be incorporated into the daily lives of patients and can be especially useful in treating chronic pain. Psychological and emotional therapy can include relaxation techniques, music, breathing, art therapy, distraction, meditation, or cognitive behavioral therapy. Changing the environment can also help patients manage their pain. Adjusting lighting, sounds, and temperature to a more relaxing environment has been shown to reduce pain (Ford, 2019). Exercise and physical therapy can also help reduce pain without the side effects of pharmacological therapy. Patients can easily incorporate nonpharmacological therapy such as physical therapy into their daily lives without risks.

Physical Therapy

Many healthcare providers prefer using **physical therapy** over pharmacological therapy when treating pain (Nall, 2021). Physical therapy involves working with a trained professional to use exercise and movement to improve strength and flexibility. Physical therapy can help chronic conditions such as arthritis, nerve pain, and fibromyalgia (Figure 16.10) (Nall, 2021).

FIGURE 16.10 Physical therapy and movement can help patients feel more relaxed and reduce pain through improved strength and flexibility. (credit: "Naval Hospital Jacksonville Physical Therapy 220926-N-QA097-055" by Navy Medicine/Flickr, Public Domain)

Research shows that physical therapy and exercise improves mobility and overall quality of life (Nall, 2021). Physical therapy and exercise can also lead to weight loss, which can reduce joint and back pain. Exercise can also promote relaxation and stress reduction. Yoga combines movement with breathing and meditation. Yoga can help

improve strength, balance, flexibility, and mental health (Nall, 2021).

Physical therapy and exercise do not need to be intense or complicated to be effective. Nurses should educate patients about easy ways to incorporate movement into their daily lives and can help patients find a level of physical therapy that works for them.

Massage

Massages can help relax patients and provide pain relief by loosening tight muscles. A **massage** is a form of therapeutic touch where a therapist uses touch and pressure to loosen tight muscles and tendons. Touch and pressure block pain signals, which relieves pain and improves the blood flow to tight muscles, which in turn can promote relaxation (Nall, 2021).

Patients should be cautious with massages if they have a skin rash, infection, certain cardiovascular diseases, or are pregnant. Otherwise, there are minimal risks and side effects with massage (Nall, 2021). Sometimes, patients may experience pain during the massage due to the intense pressure of the therapist. Nurses can educate patients to ask their massage therapist to use varying amounts of pressure to provide relaxation and pain relief.

Guided Imagery

A relaxation technique called **guided imagery** can help ease pain and promote relaxation. It is a technique that uses images or scenes to invoke positive and relaxing feelings. The goal of guided imagery is to stimulate natural relaxation responses to reduce pain, slow breathing, decrease blood pressure and heart rate, and decrease feelings of stress (West, 2022).

Guided imagery can be done with or without direction. Once patients are familiar with guided imagery practice, it is easy to incorporate it into their daily lives. Guided imagery consists of imagining anything the patient deems as relaxing or calming. For example, a patient may imagine being on the beach on a warm, sunny day and listening to the ocean sounds. Another patient may imagine their body fighting off cancer or a chronic illness and being able to function without pain. The image can be whatever the patient chooses, but they should try to engage all their senses during guided imagery (West, 2022). Patients can also use a therapist, an audio recording, or an app to direct them through guided imagery.

The process of guided imagery includes the following steps:

1. Choose a quiet place without distractions.
2. Get in a comfortable position and close your eyes.
3. Focus on whatever image you choose and engage all your senses.
4. Continue to add more details to the scene and visualize the scene for as long as is needed.
5. Gradually open your eyes and reengage with the present environment (West, 2022).

Guided imagery can be especially helpful in patients with chronic pain. Patients who suffer from pain on a daily basis often seek alternative therapies to help manage their pain. Guided imagery can be an easy method for patients to incorporate into their daily lives and on the go.

LINK TO LEARNING

Guided imagery scripts (https://openstax.org/r/77gdimagescpt) can be used to help promote relaxation and reduce pain. Guided imagery scripts can be tailored toward specific scenarios, such as sleep promotion, pain reduction, or reducing panic attacks.

Distraction

Another important tool for nurses to use in pain management is **distraction**. Distraction is a method that moves patients' attention away from pain (Ibitoye et al., 2019). Distraction moves patients' attention away from pain by modifying the nociceptive responses to decrease pain. Methods of distraction include music, videos, conversation, games, interactive toys, and controlled breathing. Music specifically can help reduce pain and relax patients. Music is often used as a pain reduction tool before, during, and after surgery. Research has found that listening to music when having surgical procedures can help reduce anxiety and pain (Nall, 2021).

Distraction can especially help reduce pain in pediatric patients. Blowing bubbles, playing games, and watching videos can help reduce anxiety and pain in children. Younger children are more easily distracted, and more invasive interventions can often be avoided if distraction is used effectively in pain management (Trottier et al., 2019).

Biofeedback

Biofeedback is a technique that uses visual or auditory feedback to control bodily functions such as heart rate and breathing patterns. During **biofeedback** therapy, sensors are used to measure bodily functions and show changes with different adjustment methods. When the body is in pain, physical factors such as heart rate, respiratory rate, and muscle contraction can change. Biofeedback helps a patient recognize these changes and make a conscious effort to relax. Decreasing heart rate and respiratory rate, as well as relaxing muscles, can help stimulate pain reduction in patients. Patients who suffer from chronic pain are ideal candidates for biofeedback therapy, as patients typically need multiple sessions to see results. Biofeedback is a popular nonpharmacological pain intervention due to its minimal risk and side effects (Mayo Clinic staff, 2023).

Biofeedback machines are available in physical therapy clinics, hospitals, and outpatient clinics. Some biofeedback machines are now available for home use. During biofeedback therapy, electrical sensors will monitor brain waves, body temperature, muscle contraction, heart rate, and respiratory rate. A healthcare provider will monitor these sensors and make suggestions to the patient to try to alter these bodily functions. Over time, the patient can learn to make these alternations without monitoring (Mayo Clinic, 2023).

Patient-Controlled Analgesia

Hospitalized patients with severe pain may receive **patient-controlled analgesia (PCA)**, which allows the patients to safely self-administer opioid medications using a programmed pump. PCA is used to treat acute, chronic, labor, and postoperative pain. A computerized pump contains a syringe of opioid analgesics and is connected directly to a patient's intravenous (IV) line. Doses of medication can be self-administered as needed by the patient by pressing a button. However, the pump is programmed to only allow administration of medication every set number of minutes with a maximum dose of medication every hour. These pump settings, and the design of the system requiring the patient to be alert enough to press the button, are safety measures to prevent overmedication that can cause sedation and respiratory depression. For this reason, no one but the patient should press the button for administration of medication (not even the nurse). In other cases, the PCA pump delivers a small, continuous flow of pain medication intravenously with the option of the patient self-delivering additional medication as needed, according to the limits set on the pump. PCA is useful for patients who have acute pain due to conditions such as trauma, burns, or pancreatitis (Pastino & Lakra, 2023). Patients with mild chronic pain may be good candidates for PCA.

REAL RN STORIES

Managing a PCA Pump for the First Time

Nurse: David, BSN
Clinical setting: Medical ICU
Years in practice: 1
Facility location: Hospital in a small town in Nevada

I had just started working in the medical ICU at my hospital as a new graduate nurse. Our orientation was about ten weeks, and I was almost to the end of my orientation. I was working with my preceptor but was pretty much doing everything on my own at that point.

We would occasionally get postsurgical patients, and that day I was assigned my first postsurgical patient. I was told this patient had undergone surgery to repair a femur fracture and would be in traction and have a PCA. The patient was coming to the ICU from the operating room (OR) in the next thirty minutes. I was very nervous, but my preceptor reassured me that I could handle this patient assignment.

When the patient arrived, they were screaming in pain and had wires and lines everywhere from the OR. Together with my preceptor and charge nurse, we quickly got the patient into the room and connected to the monitors. We

surveyed the lines and verified the medications that were currently running. The OR nurse and anesthesia gave a quick report as they "had to get moving on the next case." I was surprised that I did not get a chance to ask any questions. My preceptor said that often happens with postsurgical patients and we can always call the OR if we have questions later.

I then went to look at my patient's PCA pump. I was nervous because I had never seen a PCA pump and was not sure what it was. I remember hearing about them in nursing school but had no clue what I was supposed to do with it. My preceptor helped me look up the medication dose and rate in the MAR and showed me how to verify that the pump was set to the correct dose. She showed me how to document the dual nurse sign-off and the volume remaining in the pump. She then told me it was important to ensure the patient knew how to use the pump. The patient was fully awake from anesthesia and was able to answer our questions appropriately. My preceptor told me that you cannot let a confused or sedated patient use a PCA pump because they cannot always understand how it works. The patient verbalized our teaching and answered our pain assessment questions.

Throughout the rest of my shift, I frequently checked the PCA and the patient's pain levels. The patient expressed minimal pain throughout my shift and used the PCA periodically. I was shocked that the PCA managed to control the patient's pain so well right after surgery. My preceptor explained that PCA was a common form of pain management after surgery because it works so well. Even though setting up and managing the PCA was scary, I am glad I had the experience and the support of my preceptor to learn a new skill.

Benefits of PCA

The ability of the patient to self-administer pain medication has been shown to increase patient satisfaction and deliver timely pain interventions (Pastino & Lakra, 2023). It also reduces the stress of the nurse and patient of having to adhere to a dosing schedule of PRN analgesics that may not be adequate to treat the patient's pain. PCA may be a good option for patients who are unable to tolerate oral pain medications or for patients who have breakthrough pain and need frequent dosing. The patient can time their own medication according to the pain severity for better pain reduction and control.

Nursing Considerations for PCA

PCA pumps must have certain orders relating to the bolus dose, basal rate, and lockout time. The bolus dose is the dose that the patient receives each time they press the button on the PCA pump and is used for breakthrough pain. The **basal rate** is the continuous rate of the medication that maintains effective pain management. The lockout time is the amount of time after a bolus dose that the pump will not administer medication to the patient, even if they press the button, to prevent overdose. The PCA doses may be dependent on the type of medication, IV site, patient's weight, current research, and facility guidelines (Pastino & Lakra, 2023). It is important to review your facility's guidelines when programming PCA dosing.

There are contraindications for PCA. If the patient cannot understand how the PCA works and follow directions, they would not be good candidates for PCA. Allergies, infection, increased intracranial pressure, chronic kidney failure, and bleeding disorders are also contraindications for PCA (Pastino & Lakra, 2023).

Side effects of PCA use are the same as opioids and include constipation, nausea and vomiting, urinary retention, and pruritus (itching). The most serious potential adverse effect of opioids is respiratory depression. Respiratory depression is usually preceded by sedation. The nurse must carefully monitor patients receiving opioids for oversedation, which results in decreased respiratory rate. Patients at greatest risk are those who have never received an opioid and are receiving their first dose, those receiving an increased dose of opioids, or those taking benzodiazepines or other sedatives concurrently with opioids. If a patient develops opioid-induced respiratory depression, the opioid is reversed with naloxone (Narcan) that immediately reverses all analgesic effect.

Nurses must follow facility guidelines when administering PCA and ensure that the pump is set up correctly. Many facilities have safeguards in place such as a dual nurse sign-off, scanning medications into the electronic medication administration record (eMAR), and guardrails on the pumps to prevent medication errors. To document the amount and frequency of pain medication the patient is receiving, as well as to prevent drug diversion, the settings on the pump are checked at the end of every shift by the nurse as part of the bedside report. The incoming and outgoing nurses double-check and document the pump settings, the amount of medication administered during the previous shift, and the amount of medication left in the syringe.

Summary

16.1 The Pain Process

Pain can be classified and described in many different ways. The duration, location, and cause are all important factors when assessing and treating pain. The physiologic process of pain describes how the brain is alerted to painful stimuli and how it can modify and adjust the amount of pain that is felt in the body. Biological, psychological, and social factors can affect the perception of pain and impact how patients react. The central nervous system can also determine which pain signals are allowed through to the brain. This gate control theory can help nurses understand how pain is perceived under different circumstances.

Nurses must be aware of the factors that can affect pain and patients' perceptions of pain. One patient may perceive pain differently than another patient does, but both are right in their assessment. Nurses must accept the pain as whatever the patient says it is and individualize pain management strategies for each patient.

16.2 Responses to Pain

Physiologic, behavioral, and emotional responses to pain are the brain's way of keeping the body safe in signs of danger. The sympathetic and parasympathetic nervous systems allow the body to initiate responses that either fight or run away from a perceived threat. Behaviors, emotions, and vital sign changes such as elevated blood pressure, heart rate, and respiratory rate can all be ways that patients express signs of pain.

Behavioral and emotional responses to pain can vary among patients. Some patients may vocalize their pain or express body movements and social interactions that demonstrate pain. Some patients may experience negative emotions such as fear and anxiety when dealing with pain. Nurses must be aware of all physiologic responses to pain and know that these responses can vary greatly among patients. Physiologic responses to pain are involuntary and are often the first reaction a patient will have to pain. These responses can help healthcare providers assess pain and develop effective strategies for managing pain.

16.3 Factors Affecting Pain

There are many factors that play a role in pain. Psychosocial factors can influence a patient's perspective on pain. A patient who associates pain with trauma may have a hard time coping with chronic pain. Physiological factors such as developmental level and age can change a patient's perception and expression of pain over time. A patient's psychological view of pain can influence how effective pain management strategies can be. A patient who catastrophizes their pain may have worse outcomes than a patient who expects their pain medication to be effective. Nurses play an important role in educating patients about these factors. Patients' awareness of these factors and their effect on pain can make a big difference in pain management outcomes.

16.4 Pain Assessment

A comprehensive pain assessment must include subjective and objective data. Collecting subjective data involves choosing an appropriate pain rating scale, asking open-ended assessment questions, and accepting the pain is whatever the patient says it is. Collecting objective data involves performing a physical assessment, measuring vital signs, and assessing nonverbal behavior. Each pain assessment may have different ways of collecting subjective and objective data. The nurse should choose the pain assessment tools that are appropriate for each patient.

Pain assessments, interventions, and evaluations should be performed and documented in a timely manner to ensure adequate pain relief is achieved. Documentation of pain management ensures the patient receives timely and effective treatment. Pain management strategies cannot be deemed effective without comprehensive assessment and documentation. Pain management is an ongoing concern for patient care, and a quality pain assessment is the first step to effective pain relief.

16.5 Pain Management

There are many different types of interventions that can be used for pain management. Pain management should always include patient involvement and a combination of nonpharmacological and pharmacological interventions. Nurses have a responsibility to provide adequate pain management to all patients and will encounter pain in all types of healthcare settings.

Pharmacological therapy can be very effective in managing pain but must be used with caution. There are many risks and side effects, especially with opioid analgesics. Nurses must be aware of the risks and ensure patients are educated on appropriate dosing and monitoring when taking these medications. Patient-controlled analgesia (PCA) can also be an effective way to manage pain and involve the patient in their care. However, PCA is also not without risks. Nurses must be vigilant when monitoring a patient receiving PCA and ensure the patient meets criteria to be able to understand how to use PCA.

Nonpharmacological therapy can also be an effective pain management strategy, especially when paired with pharmacological therapy. Interventions such as physical therapy, guided imagery, and distraction can be effective pain management strategies without the same risks as pharmacological therapy. Nonpharmacological pain interventions have been shown to be effective in treating all types of pain and allow patients to avoid the side effects and risk of chronic issues such as addiction and overdose from opioid analgesics. Being aware of all types of pain management strategies is essential for all nurses and helps nurses effectively manage pain.

Key Terms

acute pain pain that is short in duration and caused by an acute event
adjuvant analgesic medication that is not classified as an analgesic but has been found to have an analgesic effect with opioids
affective response the emotional interpretation of pain, such as how uncomfortable the pain is
algophobia the extreme fear of pain
analgesic medication used to relieve pain
basal rate the continuous rate of the medication that maintains effective pain management
biofeedback a technique that uses visual or auditory feedback to control bodily functions such as heart rate and breathing patterns
breakthrough pain pain that persists along with chronic pain even with pain interventions
catastrophizing picturing the worst possible outcome for a situation
chronic pain pain that persists for longer than three months
cutaneous pain pain that is perceived from the skin and caused by heat, cold, or mechanical or chemical stimuli
distraction a method that moves patients' attention away from painful stimuli
distress extreme physical or mental suffering such as pain, anxiety, or sadness
etiology of pain the specific cause of pain
fight-or-flight response the automatic response from the sympathetic nervous system to a perceived stressful or dangerous situation, which triggers the body to either run away from or fight the perceived threat
first line therapy medical treatment that is recommended as the best option for the initial treatment of a disease or medical condition
guided imagery a relaxation technique that uses images or scenes to invoke positive and relaxing feelings
idiopathic pain chronic pain from an unknown origin
massage a form of therapeutic touch where a professional uses touch and pressure to loosen tight muscles and tendons
McCaffrey Initial Pain Assessment Tool a pain assessment tool that uses visual aids and questions including elements of the PQRSTU mnemonic to provide a comprehensive pain assessment
modification of pain a change by the brain in the intensity of the pain signal based on the situation that originated the pain signal
neuropathic pain pain caused by neurological damage or dysfunction
neurotransmitter a chemical that carries messages between neurons to communicate throughout the body
nociception the process by which painful stimuli are detected by nociceptors and send the pain signals from the peripheral nervous system to the brain
nociceptive pain pain that originates in the peripheral nervous system from stimulation by heat, cold, or mechanical or chemical stimuli
nociceptor a type of sensory receptor in the peripheral nervous system that responds to potentially damaging stimuli by sending nerve signals to the central nervous system
nonopioid analgesic medication, including nonsteroidal anti-inflammatory drugs (NSAIDs), used for acute and chronic pain relief
nonpharmacological therapy interventions that reduce pain without using medication

nonsteroidal anti-inflammatory drug (NSAID) medication that provides mild to moderate pain relief while also reducing fever and inflammation by inhibiting the production of prostaglandins
opioid analgesic powerful prescription medication that helps reduce pain by blocking pain signals
parasympathetic nervous system the part of the autonomic nervous system that opposes the sympathetic nervous system and regulates automatic bodily functions in times of rest and relaxation
patient-controlled analgesia (PCA) a form of pain medication administration that allows hospitalized patients with severe pain to safely self-administer opioid medications using a programmed pump
pharmacological therapy the use of medication to treat a disease, illness, or medical condition
physical dependence a condition in which a patient experiences physical symptoms of withdrawal when stopping a medication
physical therapy the use of exercise and movement to improve strength and flexibility
physiologic response the body's involuntary response to a stimulus such as inflammation or changes in heart rate and blood pressure
physiological factor a physical factor that relates to a person's perception of pain
placebo effect an improvement in a condition, such as the lessening of pain, that occurs due to the patient believing a treatment will be effective
post-traumatic stress disorder (PTSD) a psychiatric disorder in which a person experiences lingering effects triggered by a past traumatic event
psychosocial factor a social factor that relates to a person's perception of pain
referred pain pain perceived at a location other than the site originating the painful stimulus
somatic pain pain that originates in ligaments, tendons, bones, blood vessels, and muscles
tolerance a built-up resistance of the body to a medication
transduction of pain the starting point of the pain process when stimuli activate nociceptors to alert the brain
transmission of pain the second step of the pain process when the pain signal is sent from the peripheral to the central nervous system
visceral pain pain that is activated when internal organs such as the stomach and kidneys are damaged
vocalization the use of sounds, noises, and words to express pain
Wong-Baker FACES Pain Rating Scale a visual pain assessment tool using drawings of different faces exhibiting increasing levels of pain

Assessments

Review Questions

1. What step in the pain process involves the gate control theory of pain?
   a. transduction of pain
   b. transmission of pain
   c. perception of pain
   d. modification of pain

2. The nurse is providing a class to nursing students on chronic pain management. What example describes chronic pain?
   a. a patient admitted to the hospital for a femur fracture
   b. a patient experiencing back pain from a car accident last year
   c. a patient receiving first aid for burning their hand on the stove
   d. a patient experiencing a ruptured aneurysm

3. A patient is complaining of right ankle pain that feels "dull and aching." The nurse documents this as what type of pain?
   a. cutaneous
   b. visceral
   c. somatic
   d. referred

4. The nurse is providing a class to nursing students about pain. How would the nurse define pain to the

students?

a. an unpleasant sensory and emotional experience associated with actual or potential tissue damage
b. an objective experience that is defined by a pain rating scale
c. an unpleasant sensation that can only be treated with medications
d. an unpleasant sensation for a short duration and in a specific location

5. The nurse is caring for an older adult patient who has been experiencing back pain. The nurse asks the patient to rate their pain and the patient states "I am not in pain. I am fine." The nurse knows the patient could have what factor impacting their perception of pain?

a. medical diagnosis
b. culture
c. age
d. cognitive function

6. The nurse is explaining the sympathetic response to pain to a student who has just started their orientation in the emergency department. What statement does the nurse make about the sympathetic response to pain?

a. "It is an involuntary reaction to pain that keeps the body safe from danger."
b. "It helps the body relax and rest after perceived pain."
c. "It involves facial expressions and vocal expressions of pain."
d. "It can include emotions such as fear and anxiety in connection to pain."

7. The nurse is caring for an infant patient and knows what physical response or sign is most likely going to be present in an infant in pain?

a. increased blood pressure
b. decreased heart rate
c. crying
d. withdrawal from touch

8. The nurse is caring for a patient experiencing chronic pain due to bladder cancer treatment. The nurse knows the patient is at risk for what type of behavioral response to pain?

a. vocalization of pain
b. social withdrawal
c. algophobia
d. catastrophizing

9. A patient dealing with chronic pain is seeking help with their anxiety. The patient states "My anxiety has gotten so much worse since this pain began." The nurse can make what recommendation to the patient to treat anxiety in chronic pain?

a. cognitive behavioral therapy
b. opioid analgesics
c. avoiding potential painful situations
d. treating the chronic pain

10. The nurse is teaching a class on pain management and is discussing the physiologic response to pain. What would the nurse state is a sign of the sympathetic response to pain?

a. lowering blood pressure
b. directing the pancreas to create insulin
c. slowing digestion
d. constricting pupils to limit light

11. The nurse is caring for a patient who is struggling to cope with their chronic pain from cancer treatment. The nurse knows what factor can make a positive difference in the patient's perception of pain?

a. strong social support

b. quitting their job
c. avoidance
d. catastrophizing

12. The nurse is caring for a preschool-aged patient who is admitted for abdominal pain. How would the nurse expect the patient to express their pain?
a. catastrophizing
b. accepting the pain is normal
c. physical resistance and anger
d. appear quiet and reserved

13. What is the definition of the placebo effect?
a. when a patient thinks of the worst possible outcome for their pain
b. when pain intervention proves to be effective because the patient believed it would be
c. when the patient experiences extreme physical or mental suffering
d. when the patient experiences pain because they expect it

14. The effect of trauma on the perception of pain is what type of factor?
a. psychological
b. psychosocial
c. physiological
d. cultural

15. The nurse is caring for an 80-year-old patient who has come into the emergency room to be monitored after a fall at home. The nurse knows the patient is at risk for what factor impacting their pain?
a. age
b. trauma
c. distress
d. expectation

16. A 40-year-old patient diagnosed with congestive heart failure is laughing and eating dinner with his visiting family. When asked to rate his pain on a numeric rating scale, the patient rates his pain as an 8 out of 10. What would the nurse conclude is the patient's pain rating?
a. It is what the patient says it is.
b. It is less severe due to the patient's behaviors.
c. It is in anticipation of future pain.
d. It is not accurate and the patient is exhibiting drug-seeking behaviors.

17. A patient comes to the emergency department with reports of decreased physical mobility, nausea, lack of appetite, and a "strange ache" in her back. What is the nurse's initial focus?
a. starting IV fluids for dehydration
b. performing a comprehensive pain assessment
c. ordering a physical therapy evaluation
d. administering antiemetic medications

18. The nurse notices a 6-year-old patient grimacing and moaning as he walks to the bathroom. The patient does not respond when the nurse asks the patient to rate his pain on the numeric rating scale. What is the nurse's response?
a. Accept the patient's lack of response as an indication of no pain.
b. Clarify the patient's pain rating using the FACES Pain Scale.
c. Ask the patient's parents to rate his pain.
d. Ask the patient to rate his pain using the same scale again.

19. For a patient who is cognitively impaired and cannot use a pain scale, what vital sign changes may indicate the patient is experiencing pain?
   a. decreased blood pressure
   b. decreased respiratory rate
   c. increased heart rate
   d. increased oxygen saturation

20. What should the nurse document when evaluating an intervention for pain?
   a. current pain level and any symptoms
   b. vital signs
   c. head-to-toe assessment
   d. skin assessment

21. What is biofeedback therapy used for?
   a. controlling bodily functions such as heart rate to decrease pain
   b. controlling pain using a programmed pump
   c. decreasing pain through exercise and movement
   d. decreasing pain through positive imagery

22. The nurse is caring for a patient who was recently prescribed opioids following surgery. What is the best nursing intervention to prevent the side effect of constipation?
   a. increasing fluids and exercise
   b. monitoring for respiratory depression
   c. using stool softeners as needed
   d. increasing the patient's diet to promote motility

23. The nurse is caring for a patient with pancreatitis that has been unable to take oral pain medications. What is the best action for the nurse?
   a. administering antiemetic medication
   b. using massage as a pain intervention
   c. initiating biofeedback therapy
   d. requesting a PCA order from the practitioner

24. The patient states they have been consuming acetaminophen frequently for the past several days to reduce their back pain. What side effect would the nurse be concerned about?
   a. gastrointestinal bleeding
   b. liver damage
   c. respiratory depression
   d. constipation

25. What safeguard should the nurse initiate to prevent medication errors when caring for a patient receiving a patient-controlled analgesic?
   a. checking the pump settings with the oncoming nurse
   b. decreasing the patient's dose to prevent side effects
   c. monitoring the patient for respiratory depression
   d. ensuring the pump alarms are at full volume

Check Your Understanding Questions

1. Describe the steps of how a pain stimulus travels to and is perceived by the brain.

Review the following examples of behavioral responses to pain and identify which type of behavioral response is being demonstrated.

2. An infant crying in their mother's arms after being fed and changed.

3. A patient sitting in the waiting room with their eyes closed and jaw clenched.
4. A patient complaining of knee pain but refusing to let the nurse examine the knee.
5. When conducting a thorough pain assessment, what questions should be asked in addition to using a numeric rating scale?

Reflection Questions

1. Using the gate control theory of pain, what nursing interventions would be effective for a patient with back pain?
2. What background information might you want to know about your patient who is a veteran complaining of chronic pain?
3. What information would the nurse need to determine pain in a patient who is unable to state their pain rating?

What Should the Nurse Do?

The nurse is caring for a patient who has arrived in the emergency room complaining of pain. The nurse brings the patient into an exam room to begin the assessment. The patient is frowning and is guarding their stomach. The patient states their pain began two hours ago and is "killing me."

1. What information would the nurse want to know to identify the type of pain the patient is experiencing?
2. What tools and questions could the nurse ask to get more information about the patient's pain?
3. Based on this information, what type of pain do you think the patient is experiencing?
4. The nurse is caring for a patient who is admitted for abdominal pain. The patient's 0800 vital signs were as follows: heart rate 70 bpm, respiratory rate 14 bpm, blood pressure 110/75, oxygen saturation 98 percent on room air. The nurse enters the room for the 0900 assessment and the patient is complaining of pain. The nurse notes the patient's vital signs are now: heart rate 118 bpm, respiratory rate 20 bpm, blood pressure 164/80, oxygen saturation 96 percent on room air. What should the nurse do next?
5. The nurse is caring for a patient who is admitted for ongoing abdominal pain. The patient has just been diagnosed with pancreatic cancer and has a history of high blood pressure, diabetes, and depression. The patient has been in the hospital for several days and has just started chemotherapy. The nurse is educating the patient on the possible side effects of the medication and notes the patient appears quiet and withdrawn. The nurse notes that there is no family at the bedside. The nurse asks the patient if there is anything wrong. The patient starts crying and states "I just don't know how I am going to survive all of this." What psychosocial factors might affect the patient's perception of pain?

The nurse is caring for an older adult patient with a history of arthritis who is complaining of chronic joint pain in their knees.

6. What pharmacological interventions could the nurse recommend for this patient?
7. What nonpharmacological interventions could the nurse recommend for this patient?

Competency-Based Assessments

1. Describe how the nurse would recognize the patient is demonstrating a physiologic pain response.
2. Develop a comprehensive pain assessment, including subjective assessment questions and objective assessment criteria, for an adult patient with a history of pancreatitis who is admitted for abdominal pain.
3. Describe the process of the dual nurse sign-off when verifying the patient-controlled analgesic (PCA) pump and how to monitor a patient on a PCA pump for side effects.
4. Describe the appropriate procedure for administering opioid analgesics to a patient.

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CHAPTER 17
Nutrition Assessment

FIGURE 17.1 Proper nutrition, which includes a balanced diet, is linked to improved health and bodily functioning. (credit: "Fresh cut fruits and vegetables.jpg" by Peggy Greb, U.S. Department of Agriculture, Public Domain)

CHAPTER OUTLINE

17.1 Nutritional Concepts
17.2 Factors Affecting Nutrition
17.3 Specialized Diets
17.4 Nutritional Assessment

INTRODUCTION Good nutrition is essential to healthy living and disease prevention. Nutritious meals provide nutrients to power all the cells of the body and enable biochemical processes that humans need to engage in an active, satisfying life. While nutritional needs across a person's life span vary, the need for quality, nutrient-rich food never changes. Regardless of their cultural, religious, or economic background, everyone benefits from healthy lifestyle choices and dietary patterns.

Unfortunately, unhealthy dietary patterns not only risk immediate health needs but are also associated with the development of chronic disease. In the United States, 60 percent of the population has been diagnosed with at least one chronic medical condition due to unhealthy dietary practices (USDA, 2020). Whether it is diabetes, heart disease, obesity, or eating disorders, no one is immune from the consequences of poor nutrition. Nurses are on the forefront of health promotion; thus, it is essential for nurses to have a clear understanding of the relationship between food and health. Nurses must teach the importance of good nutrition and understand how specialized diets are used to promote optimal health. Most importantly, nurses must be competent in the skill of nutrition assessment and evaluation across a person's life span.

17.1 Nutritional Concepts

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Explain how nutrition supports energy production
- Recognize nutrients used for energy in the body
- Recall nutrients used for regulation in the body
- Describe optimal nutritional status for proper bodily functioning

The science of nutrition has impacted clinical care in significant ways. As scientists learn more about the roles and uses of nutrients in health and medicine, new and improved nutritional guidelines and recommendations are developed. The **Dietary Reference Intake (DRI)** are scientifically developed reference values that set baseline standards and guide recommendations for daily nutritional intake. The U.S. Department of Agriculture (USDA) uses **Recommended Dietary Allowances (RDAs)**, which provide general guidelines for consuming the nutrients that make up a healthy diet each day. RDAs help guide mealtime planning and food choices and aid in the development of food labels. They are based on DRIs to guide nutrition policy in the United States. **Reference Daily Intake (RDI)** is the average daily intake of a population. It is important for nurses to develop a sound understanding of nutrition science and clinical judgment skills regarding the implementation of healthy dietary practices. This section provides an overview of nutrient metabolism and regulation.

Energy Production

Human life cannot exist without energy. Energy fuels all the physiological demands of the human body. It is required for cellular growth, development, and regulation. It powers musculoskeletal movement, cognitive function, and neuromuscular reflexes. All living cells in the human body depend on energy derived from adenosine triphosphate (ATP). ATP is a molecule that releases energy when converted to adenosine diphosphate (ADP). This stepwise process is known as **cellular respiration**. Energy-rich nutrients (carbohydrates, fats, and proteins) are chemically broken down to provide ATP. ATP is then oxidized and converted to ADP, carbon dioxide, and water. Energy release in the form of ADP fuels all cellular functions within the body. To meet the body's metabolic demands, carbohydrates, proteins, and fats must be consumed and either digested or stored to meet the ongoing energy demands of the body.

Metabolic Requirements

The process by which substances are chemically broken down to meet the body's nutrient and energy needs is **metabolism**. The energy needs of the body require the consumption and metabolism of carbohydrates, proteins, and fats in significant quantities. These three energy-rich nutrients provide a consistent amount of energy per gram of nutrient. The **calorie** is a unit of measure for energy. Both carbohydrates and proteins provide four calories of energy per gram of nutrient, while fats provide nine calories per gram. The rate at which calories burn is called the basal metabolic rate (BMR). A high metabolic rate burns calories faster than a slow metabolic rate. Many factors influence metabolic rates, including age, sex, activity level, genetics, and overall fitness. Underlying medical conditions also significantly affect both metabolic rates and needs. Nutritional wellness occurs when cells burn calories efficiently and excess energy is stored effectively, thus achieving metabolic homeostasis.

The goal of metabolic homeostasis is to balance caloric intake with caloric need. Metabolic imbalance negatively impacts overall wellness and can occur when either too many or too few calories are consumed to meet the body's immediate needs. When calories consumed exceed caloric need, excess energy is stored as fat, which can lead to weight gain and the development of obesity, metabolic syndrome, and other chronic medical conditions. Caloric deficits can be just as detrimental. When caloric need outweighs caloric intake, a caloric deficit occurs, and the body turns to energy stores to meet energy needs. Carbohydrates, stored as glycogen in the liver, are metabolized first, followed by energy stored in fat cells. If a caloric deficit is prolonged and starvation ensues, the body will metabolize proteins, which can lead to life-threatening medical conditions and death. Metabolic homeostasis is essential to healthy living.

Body Weight Standards

Across a person's life span, body weight is greatly affected by caloric imbalances. Overconsumption and underconsumption of calories can result in body weight alterations that negatively impact overall health. Thus, it is

important for individuals to achieve and maintain an ideal body weight. The measure of **ideal body weight (IBW)** correlates with positive health benefits. An individual's IBW is influenced by individual characteristics such as height, weight, body frame, age, and sex. General guidelines have been developed using these characteristics to identify IBW standards. IBW can be a helpful tool when analyzing nutritional health based on generalized standards.

The measure of **body mass index (BMI)** is a commonly used tool that analyzes height and weight to provide a measurement relative to generalized standards. The Centers for Disease Control and Prevention (CDC) classifies BMI into the following categories: underweight, healthy weight, overweight, and obese (Table 17.1). A calculated BMI is based on an individual's height, weight, age, and sex and can be a helpful tool in determining an individual's relative fitness and overall wellness. Since body fat distribution can naturally differ by ethnicity, and other factors (such as exercise) can impact BMI, it should not be used as the only determination of nutritional and related health. There are many BMI calculators available on the web.

BMI	Weight Status
Below 18.5	Underweight
18.5–24.9	Healthy weight
25.0–29.9	Overweight
30.0 and above	Obese

TABLE 17.1 BMI Interpretation for Weight Status (Source: CDC, 2023.)

LINK TO LEARNING

BMI is a tool commonly used to provide a measurement relative to the IBW standard. The CDC provides a BMI calculator (https://openstax.org/r/77BMIcalc) to make calculating BMI easy.

Waist circumference is another commonly used measure. Waist circumference is a relative indicator of excess fat storage deposited in the midsection; it is often used as a relative measure to gauge overall caloric balance. Growth charts are used to analyze body height and weight standards across the continuum of growth and development in children through adulthood. The CDC and the World Health Organization (WHO) have developed growth charts for use in clinical settings to track physical growth trends.

LINK TO LEARNING

The CDC has developed growth charts (https://openstax.org/r/77growthcharts) to track physical growth trends in infants and children. These charts are used to promote pediatric health.

Growth charts for infants include measurements of length, weight, and head circumference; charts for children and adolescents include measures of weight and height. Growth charts trend measurements according to percentiles, which compare a measure to an average. Thus, for a child in the fiftieth percentile for weight, 50 percent of children will be above and 50 percent of children will be below that child's measure. Growth and BMI charts are useful tools for studying trends involving growth, development, and general nutrition.

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 4

Refer back to Chapter 15 General Survey, Anthropometric Measurement, and Vital Signs for Unfolding Case

Study Parts 1 through 3 to review the patient data. Mrs. Ramirez, a 68-year-old female, is brought to the emergency room by her husband. The patient reports shortness of breath with exertion and feeling "off" for the last three days. She was seen in the emergency department and is being admitted to the medical-surgical unit for observation.

Past Medical History	Patient reports shortness of breath "gets worse with walking and only gets better after sitting down for at least fifteen minutes." **Medical history:** Myocardial infarction with stents ten years ago, heart failure, COPD, GERD, and hypertension. **Family history:** Married for fifty years, three grown children. Mother deceased from Alzheimer disease. Father alive, with hypertension and prostate cancer, currently undergoing treatment. **Social history**: Former pack/day smoker, quit twenty years ago. Social drinker, one drink/week. **Allergies:** None **Current medications:** • furosemide (Lasix) 40 mg PO daily • lisinopril (Zestril) 10 mg PO daily • carvedilol (Coreg) 6.25 mg PO twice daily • 81 mg aspirin PO daily
Flow Chart	**1230:** Blood pressure: 142/78 Heart rate: 112 beats/minute Respiratory rate: 29 breaths/minute Temperature: 99.6°F (37.5°C) Oxygen saturation: 82 percent on room air Pain: 3/10 Weight: 221 lb Height: 5 ft, 5 in.

1. Recognize cues: Based on the patient's height and weight, what is the patient's BMI?
2. Analyze cues: Is the patient's BMI significant? Why or why not?

Caloric Requirements

Energy is measured in calories. The energy-rich nutrients (carbohydrates, fats, and proteins) provide a substantial number of calories per unit of weight: Carbohydrates provide 4 cal/g, proteins provide 4 cal/g, and fats provide 9 cal/g. The USDA provides guidance on daily dietary recommendations including energy requirements. According to the USDA, human energy requirements range between 1,000 and 3,200 calories per day depending on the individual. Individual estimates of energy needs vary based on a variety of characteristics including age, sex, height, weight, health status, and level of physical activity.

LIFE-STAGE CONTEXT

Caloric Needs of Older Adults

People age 65 years and older are considered older adults. Older adults are more likely to experience chronic illness and disease. They have lower caloric needs than younger people, though they still need a diet full of nutrient-dense foods because their nutrient needs increase. The caloric needs of older adults decrease due to decreases in activity, metabolic rates, and muscle mass. Chronic disease and medication can contribute to decreased nutrient absorption.

Protein and vitamin B12 are commonly underconsumed in older adults. Protein is necessary to prevent loss of muscle mass. Vitamin B12 deficiency can be a problem for older adults because absorption of vitamin B12

decreases with age and with certain medications. Adequate hydration is also a concern for older adults because feelings of thirst decrease with age, which can lead to poor fluid intake. Additionally, older adults may be concerned with bladder dysfunction so they may consciously choose to limit fluid intake. Loneliness, diminished ability to chew and swallow, and poverty can also decrease dietary intake in older adults. Organizations such as Meals on Wheels, local senior centers, and other community programs can provide socialization and well-balanced meals to older adults.

Nutrients for Energy

Carbohydrates, proteins, and fats are energy-rich nutrients consumed on a daily basis to meet the body's caloric needs. Each of these three nutrients is considered a **macronutrient** because large quantities of each are consumed daily to meet the body's energy needs. Each of these energy-rich nutrients is metabolized at the cellular level to release energy used to fuel cellular functions. Carbohydrates break down into sugars for quick release of energy to meet immediate caloric needs. Excess sugars are converted to glycogen and stored in the liver; they can be converted back to glucose for release in the bloodstream as glucose when needed. When blood glucose levels drop, fat cells, also known as lipids, break down to meet immediate caloric needs. Fat cells are complex molecules that provide a slow but very efficient release of energy. Proteins are larger molecules made up of amino acids that also provide a slow release of energy. When carbohydrate and fat energy stores are depleted, proteins are metabolized to provide needed energy. These three energy-rich macronutrients are essential to life and work in concert to meet the body's need for fuel.

Carbohydrates

A macronutrient used to fuel the immediate energy needs of the body is a **carbohydrate**. Carbohydrates are classified as simple (monosaccharides and disaccharides) or complex (oligosaccharides and polysaccharides). Simple carbohydrates are also known as sugars. Glucose, a monosaccharide, is the body's primary energy source; it is used to meet immediate energy needs. When glucose is transported into a cell, it undergoes cellular metabolism, which releases ATP and energy. Larger, complex carbohydrates are broken down by enzymes into monosaccharides to be metabolized for energy. Every gram of carbohydrate provides 4 calories of energy. Carbohydrates should make up 45 to 65 percent of a healthy diet.

Simple and complex carbohydrates differ in significant ways, though all are made up of carbon, hydrogen, and oxygen. Sugars typically taste sweet and are found in foods like honey and fruits. Complex carbohydrates are longer sugar chains that are digested in the intestines and broken down into monosaccharides that can then be used by the cells. They release energy more slowly than simple sugars. Starches, fiber, and glycogen are complex carbohydrates. Starches are polysaccharides that are digested by enzymes in the intestinal tract. Rice and potatoes are examples of starches. Dietary fiber is broken down in the large intestine by bacteria rather than metabolized by enzymes. Soluble fiber is found in fruits, vegetables, whole grains, and legumes; it helps control blood sugar by reducing absorption of postprandial blood sugar in the gut. Insoluble fiber, such as cellulose, is a bulking agent for stool.

Proteins

A macronutrient made up of amino acids is a **protein**; they are much larger molecules than carbohydrates. There are twenty different amino acids used by the human body. Nine of these amino acids must be consumed within the diet. These are referred to as essential amino acids. The other amino acids can be synthesized within the body. All proteins are made of strings of amino acids called polypeptides. During digestion, proteins are broken down into smaller units that can then be used to make new proteins. Proteins are essential to human life. They are the main building blocks for muscle, skin, and connective tissue and are involved in the growth, maintenance, and repair of body tissues. Enzymes, hormones, and hemoglobin are proteins. While proteins are not a primary source of energy, they can be broken down for glucose metabolism if cells are starved for energy. Proteins yield 4 calories of energy for every gram of nutrient.

Dietary proteins should make up 10 to 15 percent of an individual's daily caloric intake. There are situations where protein needs are higher, such as in growing children or when a person is pregnant, lactating, or experiencing a critical illness. However, excessive dietary protein can be harmful to individuals with underlying kidney impairment. Thus, it is important to maintain a protein intake that is healthy and also balanced for individual nutritional needs.

Meat, poultry, eggs, and seafood are all good sources of animal protein. Unfortunately, some of these protein sources are associated with high levels of saturated fat, which can negatively impact health and should be limited in a healthy diet. Protein from plants, such as soy products, nuts, seeds, and legumes, can supply adequate amounts of protein as well, though these sources are not metabolized as efficiently as animal protein. The USDA recommends a balanced intake of animal and plant protein. Table 17.2 compares the protein content of animal- and plant-based foods, information that is useful for developing a balanced diet while reducing saturated fat content.

Type	Source	Measure	Protein Content
Animal based	Whey powder	3 scoops	50 g
	Beef	3 oz	29 g
	Turkey	3 oz	26 g
	Lamb	3 oz	25 g
	Pork	3 oz	25 g
	Salmon	3 oz	23 g
	Chicken	3 oz	20 g
	Cod	3 oz	19 g
	Milk	8 oz	9 g
	Yogurt	4 oz	9 g
	Egg	1 whole	6 g
Plant based	Black beans	1 cup	42 g
	Peanuts	1 cup	36 g
	Pumpkin seeds	1 cup	35 g
	Almonds	1 cup	29 g
	Tofu	0.5 cup	22 g
	Edamame	1 cup	13 g
	Kidney beans	1 cup	8 g
	Peas	1 cup	8 g
	Broccoli	1 cup	6 g
	Spinach	1 cup	5 g

TABLE 17.2 Protein Content (Source: U.S. Department of Agriculture, Agricultural Research Service, Beltsville Human Nutrition Research Center, 2024.)

Fats

A large, complex molecule made up of fatty acids and glycerol is a **fat**. Fats, also known as lipids, are a highly efficient source of stored energy, releasing energy when needed at a very slow, measured rate. Each gram of fat releases 9 calories of energy.

Cholesterol and triglycerides are important lipids within the body. They are associated with essential functions including brain function, hormone regulation, and energy production. Adipose tissue, commonly found in subcutaneous fat, is composed of fat cells that help regulate energy supply within the body. Energy, in the form of excess blood sugar, is converted to lipids and stored as adipose tissue for future use. When glucose stores are depleted, the body turns to these fat stores for energy by breaking down the triglycerides in adipose tissue into simple sugars, which then release energy for immediate use within the body. Cholesterol is a key component of cell membranes; it is transported, along with triglycerides, throughout the body by protein-based compounds called lipoproteins. Lipoproteins, which are classified according to the ratio of lipid to protein, bind to cholesterol and triglycerides for transport through the body. Low-density lipoproteins (LDLs) are essential for healthy cellular function but in excess are associated with increased cardiovascular risk. LDL is often referred to as "bad cholesterol" and can be found in high-fat diets that contain fried foods, red meat, high-fat dairy products, and processed baked goods. High-density lipoproteins are considered "good cholesterol" and are beneficial to cell function. Examples of good cholesterol include nuts, seeds, fish, and legumes.

Lipids are either saturated or unsaturated; unsaturated fats may be monounsaturated or polyunsaturated. Saturated fats are associated with increased cardiovascular risk, leading to atherosclerosis, coronary artery disease, and stroke; they should be limited in a healthy diet. Animal products contain saturated fat, while fat derived from plants typically contains unsaturated fat. Trans fats are human-made fats derived from partially hydrogenated oil. Eliminating trans fats from the diet is recommended because these fats are associated with development of atherosclerosis and adversely affect cholesterol levels. The USDA recommends limiting the consumption of dietary fat to 28 percent or less of daily caloric intake. Saturated fat should be limited to 8 percent or less.

Nutrients for Regulation

Energy-dense macronutrients are not the only nutrients needed to regulate body function. Other nutrients, such as electrolytes, vitamins, minerals, and water, are required for growth, development, and maintenance of regulatory processes in the human body. Electrolytes, such as sodium, potassium, and calcium, are considered macronutrients because they are needed in relatively large quantities. Water is also a macronutrient. A **micronutrient** is a nutrient found in small quantities within the body but which is still necessary for physiological functions. Vitamins and minerals are examples of micronutrients. Table 17.3 lists the RDA of vitamins and minerals for children, and Table 17.4 lists the RDA of vitamins and minerals for adults.

Age	6–11 Months	1–2 Years	2–3 Years	4–8 Years	9–13 Years	14–18 Years
Calories (kCal)		800	1,000	1,200–1,400	1,600–1,800	1,800–2,200
Protein (g)	11	13	13	19	34	46–52
Carbohydrates (g)	95	130	130	130	130	130
Vitamin A (µg)	500	300	300	400	600	700–900
Vitamin D (IU)	400	600	600	600	600	600
Vitamin E (mg)	5	6	6	7	11	15
Vitamin K (µg)	2.5	30	30	55	60	75

TABLE 17.3 Daily Nutritional Goals for Children (Source: U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2020.)

Age	6–11 Months	1–2 Years	2–3 Years	4–8 Years	9–13 Years	14–18 Years
Vitamin C (mg)	50	15	15	25	45	65–75
Thiamine (mg)	0.3	0.5	0.5	0.6	0.9	1.0–1.2
Riboflavin (mg)	0.4	0.5	0.5	0.6	0.9	1.0–1.3
Niacin (mg)	4	6	6	8	12	14–16
Vitamin B6 (µg)	0.3	0.5	0.5	0.6	1.0	1.2–1.3
Folate (µg)	80	150	150	200	300	400
Vitamin B12 (µg)	0.5	0.9	0.9	1.2	1.8	2.4
Calcium (mg)	260	700	700	1,000	1,300	1,300
Phosphorous (mg)	275	460	460	500	1,250	1,250
Magnesium (mg)	75	80	80	130	240	360–410
Iron (mg)	11	7	7	10	8	11–15
Zinc (mg)	3	3	3	5	8	9–11
Sodium (mg)	370	1,200	1,200	1,500	1,800	2,300
Potassium (mg)	860	2,000	2,000	2,300	2,300–2,500	2,300–2,600

TABLE 17.3 Daily Nutritional Goals for Children (Source: U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2020.)

Age	19–30 Years	31–50 Years	51+ Years
Calories (kCal)	2,000–2,400	1,800–2,200	1,600–2,000
Protein (g)	46–56	46–56	46–56
Carbohydrates (g)	130	130	130
Vitamin A (µg)	700–900	700–900	700–900
Vitamin D (IU)	600	600	600
Vitamin E (mg)	15	15	15
Vitamin K (µg)	90–120	90–120	90–120
Vitamin C (mg)	75–90	75–90	75–90

TABLE 17.4 Daily Nutritional Goals for Adults (Source: U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2020.)

Age	19–30 Years	31–50 Years	51+ Years
Thiamine (mg)	1.1–1.2	1.1–1.2	1.1–1.2
Riboflavin (mg)	1.1–1.3	1.1–1.3	1.1–1.3
Niacin (mg)	14–16	14–16	14–16
Vitamin B6 (µg)	1.3	1.3	1.5–1.7
Folate (µg)	400	400	400
Vitamin B12 (µg)	2.4	2.4	2.4
Calcium (mg)	1,000	1,000	1,000–1,200
Phosphorous (mg)	700	700	700
Magnesium (mg)	310–400	320–420	320–420
Iron (mg)	8–18	8–18	8
Zinc (mg)	8–11	8–11	8–11
Sodium (mg)	2,300	2,300	2,300
Potassium (mg)	2,600–3,400	2,600–3,400	2,600–3,400

TABLE 17.4 Daily Nutritional Goals for Adults (Source: U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2020.)

Vitamins

A **vitamin** is an essential micronutrient, vital to biochemical regulation within the human body. Vitamins are exogenous (not made by the body) and must be ingested as part of a healthy diet. They are classified by solubility. Vitamins are either absorbed and transported in water (water soluble), or they are absorbed and transported in fat (fat soluble). The body's ability to absorb both fat- and water-soluble vitamins can be affected by various medical conditions. Many drugs can interfere with absorption and metabolism of vitamins. Vitamins can be toxic if taken in excess, but vitamin deficiencies can also have detrimental effects. Therefore, scientists have determined RDA for many vitamins to help reduce associated risks.

Vitamin C and the complex of B vitamins are examples of water-soluble vitamins: that is, they dissolve in water. Water-soluble vitamins are eliminated in the urine fairly quickly, so toxicities are rare. Deficiencies are often due to lack of access to quality food. Vitamin C is found in citrus fruits, vegetables, and potatoes. It helps regulate collagen, hormone, and amino acid production and assists with iron absorption and wound healing. The complex of B vitamins helps regulate a variety of physiological and neurological processes. Common B vitamins include B1 (thiamine), B2 (riboflavin), B3 (niacin), and B12 (cyanocobalamin). Foods rich in B-complex vitamins include meat, fish, eggs, and legumes.

Fat-soluble vitamins dissolve in lipids. Common fat-soluble vitamins include vitamin A, vitamin D, and vitamin K. Vitamin A is essential to maintain vision and healthy skin and is found in fish liver oils, egg yolks, and vegetables. Vitamin D helps build and maintain healthy bones and is not found naturally in food. Instead, vitamin D is absorbed through direct sunlight, though many fortified foods now contain vitamin D. Vitamin K promotes blood clotting and reduces bleeding risk and is found in dark green, leafy vegetables. Vitamin E is a fat-soluble vitamin with antioxidant properties, protecting cells against the effects of free radicals. Foods rich in vitamin E include vegetable oils, peanuts, and leafy greens. Many fat-soluble vitamins are stored in the liver and can have toxic effects on the body if

taken in excess.

Minerals

Another essential component of physiological processing is the **mineral**. Some minerals are macronutrients, and some are micronutrients. Electrolytes are macronutrient minerals that are essential to cardiac, musculoskeletal, and neurological functions. They help maintain water balance and acid-base balance. Important electrolytes include sodium, potassium, calcium, phosphorous, and magnesium. Each of these electrolytes must be balanced within a tight therapeutic range to maintain homeostasis and avoid harmful effects.

Some minerals are micronutrients and are found in minute quantities within the body. These minerals, also known as trace minerals, have RDA to avoid toxicities. Important trace minerals include iodine, iron, and zinc. Iodine is essential to thyroid hormone production and is mainly found in sea salt. Iron is an important component of blood, specifically hemoglobin. It is found in animal products. Zinc is essential to immune and metabolic processes and can be found in many meat products.

Water

Water is an essential macronutrient that must be maintained in homeostatic balance to avoid the detrimental effects of both over- and underhydration. Two-thirds of the volume of total body water (TBW) are found inside body cells (intracellular). The other third is extracellular and found in the vascular system and interstitial fluids (Figure 17.2a). TBW is roughly 50 to 60 percent of overall body weight, but the amount is age dependent (Figure 17.2b). Water is ingested and absorbed in the digestive tract and regulated by various mechanisms: the thirst mechanism, kidney function, pituitary function, and osmosis. The body loses about a liter of fluid a day through urine, sweat, and so on. Thus, the average recommended daily intake of water is 2.5 L to maintain adequate kidney function and vital capacity.

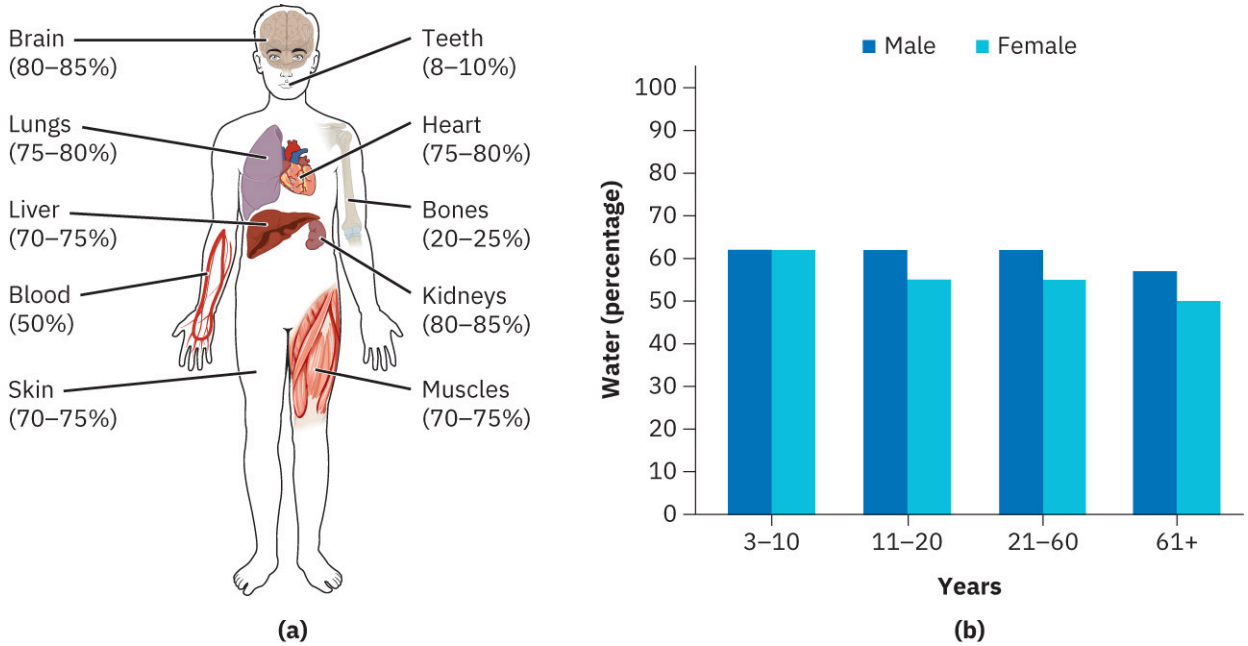

FIGURE 17.2 (a) Total body water is a critical component of a person's health. Many structures of the human body are mostly water. (b) As people age, the percentage of their bodies that consists of water decreases. (credit a: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license; credit b: data source: Lu, H., Ayers, E., Patel, P., & Mattoo, T. K. (2023). Body water percentage from childhood to old age. *Kidney Research and Clinical Practice, 42*(3), 340–348. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Optimal Nutritional Status

The human body performs best under conditions of optimal nutrition. Nutrient deficiencies can compromise the body and affect both physical and mental functioning. Likewise, excessive nutrient intake can result in toxicity. Homeostatic balance is the goal for both macro- and micronutrients. The USDA provides recommendations for daily nutrient intake and guidance on how to support daily patterns of healthy eating to promote optimal health across the life span.

Optimal nutrition begins before birth. During pregnancy, higher levels of macronutrients are needed to support the growth and development of the fetus. Following birth, good nutrition is vital to maintaining the rapid growth and development of the infant. Throughout each life stage, (infancy, toddlerhood, childhood, adolescence, adulthood, pregnancy/lactation, and older adulthood), optimal nutrition is foundational to healthy living and human flourishing. When optimal nutrition is not achieved, over time malnutrition occurs, which can lead to various negative outcomes depending on the nutritional deficit.

PATIENT CONVERSATIONS

What If Your Patient Is on a Fad Diet?

Scenario: Nurse is completing an admissions assessment on a patient being admitted with anemia, beginning with height and weight measurement. The patient sees that she weighs 140 pounds and smiles at the nurse.

Nurse: Ms. Erving, I see you're happy with your weight, huh?

Patient: Yes, I am! I've been on a diet for two months now, and I've lost over 30 pounds!

Nurse: Really? That's a lot of weight very quickly. What diet are you currently on?

Patient: I'm only eating fruits. It's called a fruitarian diet. I can eat all the fruit I want.

Nurse: So, you just eat fruit? Nothing else? No protein, dairy, grains, or vegetables?

Patient: Yes, that's right.

Nurse: Did you know that your body requires optimal nutrition to remain healthy? That includes a healthy balance of macronutrients and micronutrients. When your body doesn't get these important things in your diet, you can develop nutritional deficits.

Patient: I didn't know that. I thought my weight was the most important thing to be healthy, and being overweight was unhealthy.

Nurse: Sure, being overweight can be unhealthy, but you can be an average weight for your height and still be unhealthy. I saw in your initial lab tests that your calcium, iron, vitamin B12, and vitamin D are all low. Have you been feeling tired since you started your diet?

Patient: Actually, I have, but I didn't think it was related to what I was eating because fruit is healthy, and I was losing weight.

Nurse: Restricting your diet to only one food group is not a healthy way to lose weight. Your body needs a variety of vitamins and minerals to stay healthy. If it's OK with you, I'd like to have the nutritionist come and talk to you about how you can incorporate healthy foods into your diet for optimal nutrition and maintain a healthy weight.

Patient: Thank you, that would be great.

Malnutrition

An imbalance between the nutrients consumed and nutrients needed leads to **malnutrition**. These nutritional imbalances can result in both undernutrition and overnutrition and can involve both macronutrients and micronutrients. The RDA are a helpful tool to identify individuals at risk (see Table 17.3 and Table 17.4). However, malnutrition is multifactorial, and careful clinical follow-up is necessary to minimize long-term negative impacts of poor nutrition.

Undernutrition

Undernutrition is a state of malnutrition in which there is inadequate intake or impaired absorption of nutrients in the body. Undernutrition can be experienced across a person's life span. It often refers to calorie or protein deficits (macronutrient undernutrition), but it also includes deficiencies in vitamins and minerals (micronutrient undernutrition). Low calorie intake is a common cause of undernutrition and is commonly associated with poverty, homelessness, mental disorders, and cognitive disorders. Caloric intake can also be affected by medical conditions that restrict ingestion of food, such as dysphagia, or conditions that interfere with absorption in the gastrointestinal

tract.

Caloric deficits result in the breakdown of fats to meet the body's energy needs. Prolonged caloric deficits will deplete fat stores and stimulate the metabolism of proteins, thus causing the breakdown of muscle and tissues. Prolonged caloric deficits can lead to starvation and the visible wasting of muscle and fat. In the same manner, poor caloric intake will lead to deficiencies in essential vitamins and nutrients. The negative impact of these deficits on the body depends on the cause and severity of the deficiency. Populations most at risk include individuals with low income and those living in poverty, those who are chronically ill, children, and older adults.

Overnutrition

The WHO now includes overnutrition as a form of malnutrition. Overnutrition results from an excessive intake of nutrients, far beyond the body's need. Overnutrition results in excessive weight gain and obesity. Obesity is associated with a BMI of thirty or higher; severe obesity is associated with a BMI of forty or higher. Increasingly, children are experiencing obesity, causing the CDC to develop growth charts for children that extend the BMI-for-age (see Link to Learning: Pediatric Growth Charts). Obesity affects many aspects of health. It is associated with low socioeconomic conditions and discrimination, as well as mental stress resulting in depression and anxiety. It is a lead indicator for the development of cardiovascular disease, metabolic syndrome, diabetes, and various respiratory and musculoskeletal disorders. The population most at risk includes individuals with low incomes and those living in poverty due to the scarcity of nutritious whole, unprocessed foods. Individuals with sedentary lifestyles are at risk as well.

Hydration

As shown in Figure 17.3, the human body maintains water homeostasis through a balance of ingestion and elimination. Most water is ingested by drinking fluids, such as plain water, juices, and caffeinated beverages. Ingested water also comes from food, especially fruits and vegetables. Water that is visible and measurable as it is lost is called sensible fluid loss. Urination is an example of sensible fluid loss. Insensible fluid loss cannot be measured. An example of insensible loss is water vapor lost through breathing. Adequate hydration will balance the water that enters and exits the human body. An imbalance in hydration can lead to either a fluid volume deficit or fluid volume overload. Both of these conditions present problems, but for very different reasons.

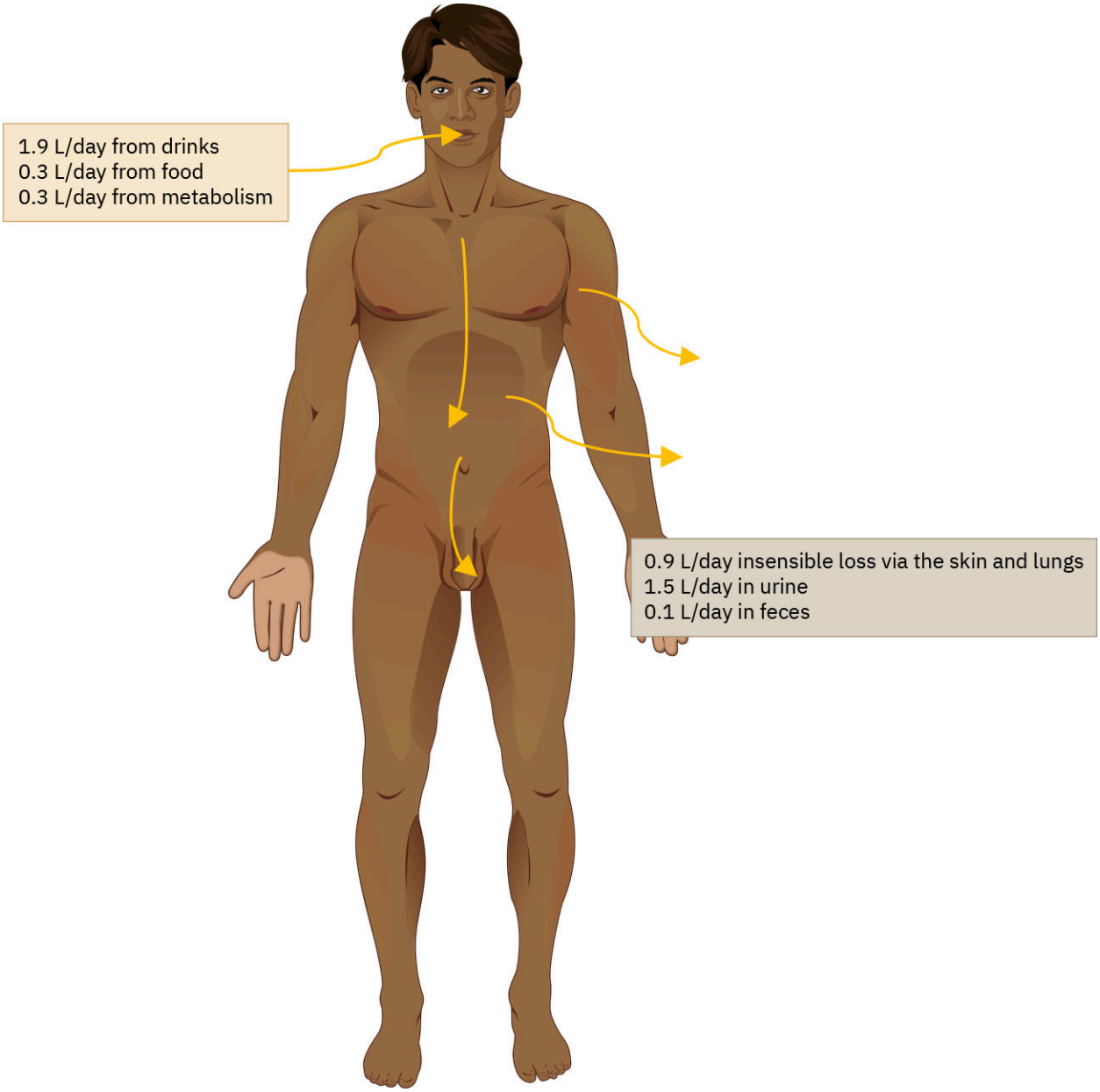

FIGURE 17.3 The human body maintains water homeostasis by ingesting and producing water and eliminating it through a number of processes. Water loss can be increased in dry climates or when a patient has diarrhea. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Dehydration

A fluid volume deficit is called **dehydration**; this occurs with inadequate water intake or excessive water loss or both. Conditions associated with dehydration include vomiting, diarrhea, prolonged fevers, and excessive sweat due to heat stroke. Some neurological conditions can impair the thirst mechanism or impair the ability to swallow, which can lead to poor fluid intake. In some cases, sodium levels are altered. Volume depletion can lead to kidney and cardiac impairment, and severe shock can result. Populations most at risk include infants and children, the chronically ill, and older adults.

Overhydration

Fluid volume overload, or overhydration, occurs with excess water intake or poor water elimination. These can lead to volume expansion affecting cardiac, respiratory, and kidney function. Impaired elimination of water in the body is a common consequence of chronic disease and is often associated with an alteration in sodium levels. The three chronic conditions that most commonly lead to overhydration are heart failure, kidney failure, and liver failure; pregnancy is another common cause of overhydration. Symptoms of fluid overload include pitting edema, ascites,

and dyspnea and crackles from fluid in the lungs. Edema is swelling in dependent tissues due to fluid accumulation in the interstitial spaces. Ascites is fluid retained in the abdomen. Treatment depends on the cause of the fluid retention. Sodium and fluids are typically restricted, and diuretics are often prescribed to eliminate the excess fluid.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety

Competent nurses will employ assessment skills to identify patients in fluid overload and to detect when they are improving or deteriorating. Take the example of Nurse Rita who works at an outpatient wound care clinic. Rita is taking care of 42-year-old Mr. Mahoney who has weekly wound care dressings scheduled for the next six weeks with labs. She has been his nurse for over five years at this same clinic.

Week 1: Blood pressure 110/65, heart rate 72, lungs clear bilaterally, Respirations 12, nonpitting edema on right lower extremity. Sodium 139, Potassium 4.2, Calcium 9.

Patient is calm, cooperative, and considers himself "a funny guy. Rita you are the best nurse here."

Week 4: Blood pressure 130/75, heart rate 80, fine crackles in bilateral lower lung bases, Respirations 16, 2 + edema on lower extremities. Pt is calm, cooperative and stated "I love your new haircut Rita."

Week 6: Blood pressure 160/85, heart rate 80, crackles heard in lower and upper lung fields bilaterally, Respirations 32, 3+ edema on lower extremities, clear drainage from right lower leg. Sodium 120, Potassium 3.1, Calcium 9.

Reports not sleeping well at night and using three pillows or sleeping in the recliner. Out of breath all the time. Produces little urine. When Rita asks about how he is sleeping, patient states "Who are you again?"

This patient has had several changes in his assessment. The competent nurse will recognize when a patient's assessment changes and report these findings to the healthcare team. This patient needed further assessment and interventions at each assessment to prevent further deterioration.

17.2 Factors Affecting Nutrition

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Analyze the physiological factors affecting nutrition
- Understand the sociocultural, behavioral, and lifestyle factors affecting nutrition
- Examine the psychological factors affecting nutrition

Good nutrition is associated with a high quality of life. This is true for all people, whether young or old, wealthy or poor, athletic or sedentary. Nutrient-rich foods and fluids must be available in adequate amounts to meet the specific metabolic needs of each individual. Meeting these needs is a dynamic process involving the ingestion, digestion, absorption, and metabolism of each nutrient according to its biochemical makeup. There are many factors that influence these biological processes. Some factors have direct, physiological effects on these processes, such as the stage of growth and development or the presence of underlying medical conditions. Some factors have subtler effects, such as cultural or religious influences. The meaning of food and its association with self-image can have psychological effects that influence a person's relationship to nutrition. This module explores some of the physiological and psychological factors that positively or negatively impact nutritional health.

Physiological Factors

Nutrition impacts many physiological processes. The physiology of digestion involves the breakdown of foodstuffs into absorbable nutrients. Digestive processes include mechanical digestion, propulsion, chemical digestion, and absorption (Figure 17.4). The process of breaking down, or metabolizing, nutrients is influenced by many factors, including the following:

- digestive organ function responsible for the breakdown, absorption, and metabolism of nutrients
- kidney function responsible for fluid balance
- cardiovascular function responsible for transportation of nutrients

- endocrine function responsible for the production of hormones that control metabolic processes
- neurocognitive function responsible for perceptions of hunger, satiety, and thirst

Bones, muscles, and sensory organs are all involved in nutrient pathways. In fact, every cell in the body utilizes nutrients. Any process that disrupts the metabolic pathways in the body has the potential to negatively impact nutritional health.

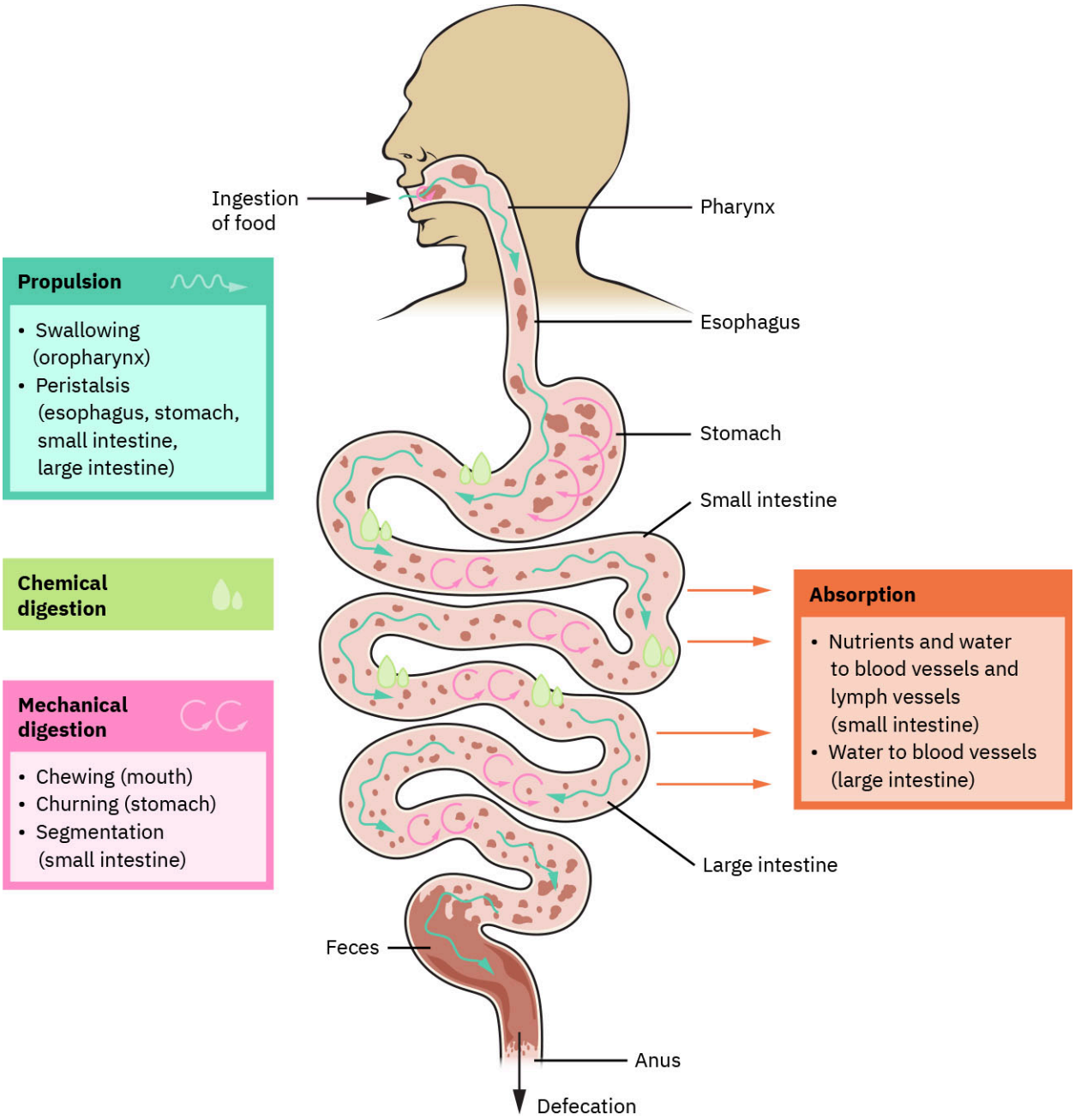

FIGURE 17.4 There are four phases of digestion, beginning with the ingestion of food and ending with the elimination of waste. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Some physiological factors have a profound effect on metabolic pathways. A person's genetic makeup, stage of growth and development, medications, and underlying medical conditions all directly impact how their body processes nutrients. Other factors, such as environment, socioeconomic conditions, and personal preferences, can directly influence food choice and nutrient availability. Consequently, it is important for the nurse to consider the holistic needs of every patient, including the many factors that influence the nutritional demands on the human body.

Developmental Level

The human body is engineered to grow and develop through structured, organized, time-sensitive processes. These processes occur naturally within the body and follow predictable patterns for physiological and cognitive maturity. Across a person's life span, nutritional requirements differ based on the unique developmental needs at each stage of development. For example, caloric needs are based on body weight, activity level, and metabolic demands. As growth and development occur, these factors change. For example, in utero body weight is low, but metabolic demands are high. At birth, growth measures, such as head circumference, length, and weight, help identify individual risk for malnutrition. As the child grows, body weight increases, activity levels vary, and metabolic demands continue.

Growth charts are tools for measuring healthy growth trends based on established height and weight norms. At each life stage, developmental markers can be tracked to help with early identification of developmental delays and abnormalities. Timely nursing intervention along the growth and development path can dramatically improve health outcomes and prevent long-term negative health effects associated with early nutritional deficits.

REAL RN STORIES

Encouraging Diet Modifications in a Family
Nurse: Julie, RN
Clinical setting: Community clinic
Years in practice: 10
Facility location: Texas

I remember when I was a student nurse, and we were assigned clinical rotations in the local community clinic. One day a mom came into the clinic to seek care for her 10-year-old. She reported her daughter had been having increased fatigue and was steadily gaining weight over the last year. The mom said, "Last year she was in volleyball and soccer and was so active; now all she wants to do is lay around watching TV and eating junk food. I am concerned she is developing unhealthy habits at an early age."

Upon further assessment, I noticed the girl's diet consisted of excessive amounts of salt, sugar, and fat. I was able to educate the mom how at this age, almost one-fourth of all American children have elevated cholesterol. We also discussed the need for increased vitamin D and calcium. I explained how these are vital requirements as her bones enlarge to prevent osteoporosis later in life. The physician ordered lab work and provided the family a referral to a nutritionist. The family and I discussed activities that sparked their interest in trying them out together, and they verbalized different diet modifications they planned to incorporate immediately. That day I left clinical feeling like I truly made a difference in this young child's life.

Age

If typical growth and development patterns occur, chronological age can predict generalized nutritional needs. Recommended DRIs provide guidelines for nutrient needs across an individual's life span. Table 17.5 provides an example. Note that the recommendations are based on weight (kilograms) and age. Consider the needs of a child versus the needs of an adult. Protein, calories, and calcium are needed in greater amounts as children grow, then level off in adulthood. There are also unique recommendations for older adults, who experience loss of muscle and bone mass and lower activity levels due to declining mobility and thus require fewer calories than their younger counterparts. Older adults also have unique dietary needs due to their higher risk of chronic disease, development of poor dentition, and socioeconomic changes that affect the type and amount of nutrients consumed.

	Age (years)						
Macronutrient	2–3	4–8	9–13	14–18	19–30	31–50	50+
Protein (g)	13	19	34	52	56	56	56

TABLE 17.5 Comparison of Male Macronutrient Needs: Toddler to Adult (Source: U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2020.)

	Age (years)						
Protein (% kcal)	5–20	10–30	10–30	10–30	10–35	10–35	10–35
Carbohydrate (g)	130	130	130	130	130	130	130
Carbohydrate (%)	45–65	45–65	45–65	45–65	45–65	45–65	45–65
Fat (% kcal)	30–40	25–35	25–35	25–35	20–35	20–35	20–35
Fiber (g)	14	20	25	31	34	31	28

TABLE 17.5 Comparison of Male Macronutrient Needs: Toddler to Adult (Source: U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2020.)

Sex

Nutritional needs differ between sexes largely due to hormone differences. A chemical mediator that circulates in the body and has a specific stimulating or inhibiting action on the target organs is called a hormone. Table 17.6 lists some of the hormones that control growth and development, metabolism, adrenal function, and stress. Sex hormones are responsible for the majority of differences between the biological sexes. These differences can result in distinctive caloric and other nutritional needs, particularly beginning in adolescence. For example, females require higher levels of iron during childbearing years due to the hormonal influences of menstruation and pregnancy. Pregnancy also changes caloric needs. More information regarding specific pregnancy-related nutritional needs is provided later in this chapter.

Endocrine Gland	Associated Hormones	Chemical Class	Effect
Pituitary (anterior)	Growth hormone (GH)	Protein	Promotes growth of body tissues
Pituitary (anterior)	Prolactin (PRL)	Peptide	Promotes milk production
Pituitary (anterior)	Thyroid-stimulating hormone (TSH)	Glycoprotein	Stimulates thyroid hormone release
Pituitary (anterior)	Adrenocorticotropic hormone (ACTH)	Peptide	Stimulates hormone release by adrenal cortex
Pituitary (anterior)	Follicle-stimulating hormone (FSH)	Glycoprotein	Stimulates gamete production
Pituitary (anterior)	Luteinizing hormone (LH)	Glycoprotein	Stimulates androgen production by gonads
Pituitary (posterior)	Antidiuretic hormone (ADH)	Peptide	Stimulates water reabsorption by kidneys
Pituitary (posterior)	Oxytocin	Peptide	Stimulates uterine contractions during childbirth

TABLE 17.6 Endocrine Glands and Their Major Hormones

Endocrine Gland	Associated Hormones	Chemical Class	Effect
Thyroid	Thyroxine (T4), triiodothyronine (T3)	Amine	Stimulates basal metabolic rate
Thyroid	Calcitonin	Peptide	Reduces blood Ca^{2+} levels
Parathyroid	Parathyroid hormone (PTH)	Peptide	Increases blood Ca^{2+} levels
Adrenal (cortex)	Aldosterone	Steroid	Increases blood Na^{+} levels
Adrenal (cortex)	Cortisol, corticosterone, cortisone	Steroid	Increases blood glucose levels
Adrenal (medulla)	Epinephrine, norepinephrine	Amine	Stimulates fight-or-flight response
Pineal	Melatonin	Amine	Regulates sleep cycles
Pancreas	Insulin	Protein	Reduces blood glucose levels
Pancreas	Glucagon	Protein	Increases blood glucose levels
Testes	Testosterone	Steroid	Stimulates development of sex characteristics including a deeper voice, increased muscle mass, development of body hair, and sperm production
Ovaries	Estrogens and progesterone	Steroid	Stimulates development of sex characteristics including the development of adipose and breast tissue, and prepares the body for childbirth

TABLE 17.6 Endocrine Glands and Their Major Hormones

Pregnancy

Nutritional requirements increase during pregnancy and lactation. The growing fetus puts increased nutritional demands on the body. Increased caloric needs require a nutrient-dense diet to maximize nutrition. Prenatal vitamins are advised to meet increased requirements for micronutrients such as iron, folic acid, iodine, choline, and vitamin D. Optimal nutritional requirements continue during lactation, when the mammary glands produce and release milk for breastfeeding. Increasing intake of pasteurized dairy, eggs, and lean proteins is a healthy way of increasing these nutrients.

Health Status

An individual's health status is greatly influenced by their overall nutritional status, and vice versa. Individuals in good health experience high levels of well-being and life satisfaction. Healthy people are physically active within their environment and engage in rewarding relationships. Physiologically, good nutrition and hydration balance lead to healthy growth and development patterns. The maintenance of a healthy body weight protects individuals by reducing the risk of chronic disease. Conversely, chronic disease states often present with significant nutritional demands that increase the risk of compromised nutritional health and negative outcomes.

Chronic illness and declining health impact nutritional status in various ways. Some chronic illnesses interfere with an individual's ability to ingest food properly. For example, a child with a cleft palate may have trouble eating enough calories, or an older adult who suffers a stroke may develop dysphagia (difficulty swallowing) and be unable to swallow food. Some chronic illnesses affect absorption of nutrients within the body. A child with cystic fibrosis may develop pancreatic insufficiency and be unable to absorb fats and proteins. Inflammatory bowel disease can result in poor vitamin B12 absorption. Many chronic diseases cause metabolic dysfunction leading to poor utilization of nutrients. Diabetes, Addison disease, and chronic kidney disease are examples of chronic diseases with significant impact on nutrient metabolism and utilization.

Every chronic disease provides a nutritional challenge. Treatment for heart disease includes restrictions on sodium and fat. Increased calcium and vitamin D are needed to treat bone disorders such as osteoporosis. Treatment for gastroesophageal reflux disease includes limiting acidic foods, spicy foods, and alcohol. There is a nutritional aspect associated with the prevention or treatment of nearly every chronic disease. Avoiding excess calories is important to both the prevention and treatment of obesity and heart disease. Controlling fat consumption reduces the risk of obesity, stroke, and heart disease. Adequate fiber in the diet reduces the risk of colon cancer. Good nutrition, as prevention or treatment, leads to better health outcomes.

Sociocultural, Behavioral, and Lifestyle Factors

Healthy lifestyles are key to wellness and reduction of chronic disease. However, lifestyles are strongly influenced by sociocultural factors that differ for different people. Culture, religion, and economic status play a significant role in food preferences and often give food and mealtimes meaning beyond the ingestion of nutrients. Environmental factors influence availability and quality of food and water. Unhealthy behaviors, such as alcohol and substance abuse, directly influence nutritional status. Many people rely on supplements to counteract the ill effects of unhealthy lifestyles and perceived nutritional deficits. In this section, we briefly explore how these sociocultural factors can influence overall nutritional health.

Culture

Cultural competence is a hallmark of patient-centered care. Culture describes the unique patterns of behavior and thought belonging to an identified group or organization. Nutrition and dietary patterns are often an integral part of cultural identity. The United States is home to a vast number of cultures. Cultural beliefs affect types of food eaten and when they are eaten. Some foods may be restricted due to beliefs or religious rituals, whereas other foods may be viewed as part of the healing process or have significant meaning to the celebrations of life. It is essential to consider cultural food preferences when planning nursing care and encourage healthy habits within the context of these foods.

CULTURAL CONTEXT

Cultural Variations

Cultural and religious beliefs often influence food selection and food intake. It is important for nurses to conduct a thorough patient assessment, including food preferences, to ensure adequate nutritional intake during hospitalization. Every culture has variations that make them unique, yet there are also similarities among many. Although a certain dish or ingredient might have originated in one country or culture, global trade has transported fruits, vegetables, and culinary practices to the entire world. For this reason, nurses must never make assumptions about their patients' diet based on culture or ethnicity. Instead, ask every patient about their food preferences and offer as many healthy choices as possible.

Religion

Religious practices can influence nutritional intake, often due to restrictions in specific foods or meal preparation. Both Jewish and Muslim laws prohibit the consumption of pork products, and Hindu scriptures promote a vegetarian diet. Restrictions may vary even within a given religion as people practice varying degrees of strictness to dietary doctrines. Some individuals may observe food restrictions in association with specific religious celebrations. For example, Catholics may observe dietary restrictions during Lent, while practicing Muslims may fast during Ramadan. Food preparation can also be influenced by religious beliefs. Some Jewish people observe Kosher laws which govern

the preparation of certain foods (e.g., beef), the prohibition of certain foods (e.g., pork and gelatin), or the combination of some food (e.g., beef served with dairy products), while some Muslim people observe Halal (the Arabic word meaning "permissible" or "lawful") which restricts the consumption of pork, alcohol, and blood products, and and calls for minimal suffering when preparing animal products. Religious practices and beliefs can be complex. It is important to support the nutritional goals of the individual patient by understanding and respecting the religious dietary practices of every patient.

Economic Status

Economic status refers to a combination of economic and social indicators that describe an individual's overall scale of wealth and status. Factors that contribute to economic status include income, educational level, occupation, and place of residence. Economic status predicts a person's ability to obtain nutritious food on a routine basis. Individuals with lower incomes have less means to obtain and prepare nutritious foods. Some individuals may live in a **food desert**: a geographical area where fresh produce and foodstuffs are either too expensive or unavailable. Federal supplemental assistance programs are available to help meet the nutritional needs of underserved and marginalized low-income populations. These include the Supplemental Nutrition Assistance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). There are also private organizations such as Meals on Wheels America. Individuals with higher incomes are not immune from nutrition concerns. Excess calories and intake of nutrient-poor foods can lead to obesity and other metabolic disorders due to easy access to food, especially fast food.

LINK TO LEARNING

The USDA developed a Food Access Research Atlas (https://openstax.org/r/77foodaccess) to show how food access varies for certain subpopulations in the United States. It can be used for research or community planning to increase supermarket access.

Environment

Community environments have a large impact on nutritional health. As stated earlier, food deserts can create areas of food insecurity among at-risk populations. This has its greatest impact on infants, children, and older adults, who are often dependent on others for meal preparation and shopping. Urbanization and industrial effects can have detrimental consequences on clean water supplies and spaces for meal preparation. War zones and refugee camps often deal with undernutrition and lack of access to safe, quality food and water.

Along with geographical environments, family structures within communities have a profound effect on nutritional status. People in a state of **food insecurity** have limited access to adequate food, typically due to economic or social factors. People experiencing the uncertainty of food insecurity or family discord find it difficult to maintain healthy eating routines. School lunch programs are a helpful resource to families in low-income neighborhoods. Older adults often experience isolation, which leads to poor nutrition habits and negative health trends. As patient advocates, nurses must gain understanding of federal and local nutrition assistance programs and implement timely referrals for their at-risk patients.

LINK TO LEARNING

Older adults are an at-risk population. Medicare is a federal program that provides access to health care for older adults, but it is not meant to meet physiological needs such as food. Unfortunately, food insecurity is a significant problem among older adults. Read the USDA's Nutrition Programs for Seniors (https://openstax.org/r/77nutritionprog) and review the various programs in place to address food insecurity in the older adult population. Research one of the programs and consider how it could be incorporated into a nutrition teaching plan for an older adult.

Alcohol Use

Because alcohol is high in calories and low in nutrient value, it can negatively impact nutritional health even when

consumed in acceptable levels. The use of alcohol can increase the risk of chronic disease and injury. Alcohol consumption is linked to elevated triglycerides. Excessive use of alcohol can lead to chronic nutrient deficiencies due to poor absorption of nutrients, fluid imbalance, gastrointestinal disorders, and liver disease. According to Healthy People 2030, binge drinking (consuming four or more drinks per day for females or five or more drinks per day for males) is a significant problem in the United States (CDC, 2022). The USDA recommends that males limit consumption to two drinks per day and females to one drink per day.

Overuse of Supplements

Supplementation of macronutrients and micronutrients has become increasingly popular due in part to marketing and fitness claims as well as easy access to over-the-counter supplements. Supplements are pills, capsules, and liquids that contain vitamins, minerals, amino acids, or other nutrients. The U.S. government does not require manufacturers of dietary supplements to prove their safety or efficacy, and thus the industry is poorly regulated. Even when supplements are accurately labeled and safely produced, their overuse can lead to toxicities, particularly in fat-soluble vitamins such as vitamin A and vitamin D. Large doses of vitamin C, vitamin B6, and niacin can also lead to toxicities. Performance-enhancing dietary supplements contain amino acids that in excess can cause liver and kidney impairment. It is important for nurses to be familiar with the RDI, RDA, and other standard nutrient recommendations and know how to assess for potential toxicities in patients taking supplements.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Evidence-Based Practice (EBP)

Definition: Integrate best current evidence with clinical expertise and patient/family preferences and values for delivery of optimal health care.

Knowledge: Explain the role of evidence in determining best clinical practice

Action: It is important for the nurse to ask the patient about any over-the-counter supplements they may be taking. Many patients do not realize that certain supplements can interact with prescription medication or that to much supplement can cause toxicity. Completing a comprehensive health assessment ensures the nurse is providing evidence-based practice.

Medications

Some medications enhance metabolic processes and impact nutritional status in a variety of ways. For example, exogenous insulin brings needed glucose into body cells. Antiglycemic medications, such as sulfonylureas and bigaunides, assist in improving insulin sensitivity, thus improving utilization of blood glucose by the cells in the body. Thyroid hormone maintains thyroid function, which sets the body's metabolic rate. Other medications affect gastric function by lowering levels of acid production. Still other medications, such as psyllium and glycolax, alter absorption of nutrients and water in the gut. Statin drugs lower lipids levels. It is important to know how medications are used within the body and how they directly influence metabolic processes.

Many medications have an indirect effect on nutritional status. For example, diuretics are used to increase elimination of water and thus will affect body water levels as well as sodium and potassium balance. Medications with gastric upset as a side effect can decrease nutrient intake and absorption. Some psychotropic medications interfere with appetite, leading to either weight gain or weight loss, depending on the drug. Nurses must be familiar with the side effects of all drugs administered to patients under their care, anticipating long-term effects on nutritional status.

Some nutrients interfere with the mechanism of action of different drugs. For example, vitamin K, found in green leafy vegetables, can decrease the effectiveness of some anticoagulants. In contrast, some drugs should be taken with food to increase absorption. For example, vitamin C improves the absorption of iron. The pharmacokinetics of a drug—the study of the drug's absorption, metabolism, and distribution within the body—determine the probability of a food-drug interaction. Food and drug interactions can cause deficiencies or toxicities depending on the drug and the food. Nurses must always review administration requirements for each drug, noting whether the drug should be taken with or without food.

PATIENT CONVERSATIONS

Educating a Patient About Medications Before Discharge

Scenario: The nurse is discharging his patient and reviewing the discharge paperwork with her. He notices that the patient is prescribed warfarin, a new medication that she will have to continue to take at home after discharge.

Nurse: Okay, Ms. Embiid, while in the hospital you've been taking warfarin. Do you know why you were taking this?

Patient: Oh, yes. It's to keep my blood from forming a clot, right?

Nurse: That's right. You'll have to continue to take this medication at home, and follow up with your doctor in two weeks. Do you know how to take this medication?

Patient: Well, I've been taking it at night here, so I guess I'll take it at night at home, too.

Nurse: That's right. The best way to take this medication is to take it at the same time every night. It's also very important to avoid cranberry juice and grapefruit juice and try to maintain the same level of vitamin K consumption every week.

Patient: Really? Why?

Nurse: Certain foods, such as cranberries and grapefruit, can actually increase the levels of warfarin absorbed by your body. High doses of vitamin K, found in green leafy vegetables, can decrease the effectiveness of warfarin. It's very important to maintain a consistent diet and not make any major changes without checking with your doctor.

Patient: Thanks for letting me know! I'll be sure to monitor what I eat while on warfarin.

Psychological Factors

Physiological factors, such as growth and development, health status, and medication use, have a direct effect on nutritional status within the body. Psychological factors can influence nutritional status as well. Emotional well-being is often closely associated with food preferences and intake. Self-image impacts nutritional well-being. Cultural trends in beauty and health provide context for self-image and give meaning to food and dietary traditions. Conversely, overall nutrition can have a significant impact on psychological well-being.

Food Meaning

Nutrition is a basic necessity of life. Maslow's hierarchy of needs (Figure 1.6) lists food as an essential physiological need. It is important to note, however, that food consumption is highly influenced by cultural and environmental factors that have a profound effect on psychological well-being. Thus, food to most people is more than a nutrient. Food is tied to family traditions and celebrations in life. Americans traditionally celebrate Thanksgiving with turkey and pumpkin pie. Many Italian Americans celebrate the Feast of Seven Fishes on Christmas Eve, and Jewish tradition serves challah bread at the Sabbath and potato latkes at Hanukkah. Similarly, vegans avoid meat and other animal products due to personal beliefs related to animal cruelty and exploitation. Many cultures have food traditions that transcend nutritional science, giving food meaning beyond its chemical composition.

Emotional responses are invoked when food meaning goes beyond mere nutrition. Most celebrations that involve food evoke feelings of comfort, happiness, and belonging. Memories, both good and bad, are often tied to the sight and smell of specific foods. Associations with sadness and grief can lead to food aversions, while foods tied to comfort can lead to food excesses as the desire to re-create moments of comfort and celebration override judgment. This can lead to binge eating and obesity. It is important for nurses to identify and reinforce healthy patterns of eating and recognize nutritional risks related to emotional eating habits.

Self-Image

Nutritional status is tied to weight trends, weight trends are tied to body image, and body image is tied to self-image. A person's **body image** is the perception that person has about their physical body, including any feelings associated with that perception, whereas self-image is broader, encompassing feelings about one's whole self. Individuals who maintain a healthy body weight are more likely to have a positive self-image—particularly given cultural norms, reinforced by media, that stigmatize bodies perceived to be over- or underweight. Distorted

perceptions of body image can lead to severe eating disorders, such as anorexia nervosa and bulimia.

Depression

As stated earlier, food often evokes an emotional response. It can provide feelings of comfort and belonging or feelings of sadness and grief. It is easy for food to become an emotional outlet for psychological discomfort, especially when the foods consumed promote feelings of comfort and belonging. Emotional eating is common among individuals who are depressed or stressed as they seek emotional responses they find lacking elsewhere in their life. The consumption of "comfort foods" is an emotional response to stress and is common among most individuals. When the dietary pattern includes a high degree of emotional eating, negative outcomes, such as binge eating and overeating that leads to obesity, are more likely to occur. It is important to assess the underlying emotional state of individuals experiencing nutritional impairment. A holistic approach to nursing care is needed.

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 5

Refer back to Unfolding Case Study #3: Part 4 to review the patient data.

Nursing Notes	**1300:** While collecting the patient's weight, she expresses concern about her weight. She states, "I know I'm not at a healthy weight, but it's just so hard to eat healthy. Healthy food is so expensive."

3. Prioritize hypotheses: What factors may be contributing to the patient's obesity?
4. Generate solutions: What steps should the nurse take next to address the patient's obesity?

17.3 Specialized Diets

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Examine the standard dietary recommendations for optimal health
- Recognize specific therapeutic diets for diseases or conditions
- Describe consistency modification diets
- Identify what enteral nutrition is and how to administer it
- Understand what parenteral nutrition is and how to administer it

Sometimes dietary intake must be adapted to meet individual nutrient needs. This may include restricting or increasing specific nutrients in the diet. It may also include modifying the consistency of the food when there is impaired swallowing or a need to give rest to the digestive tract. Sometimes nutrition must be administered via alternate means, such as directly into the stomach or via a central line. Nurses must be skilled in identifying, implementing, and evaluating therapeutic diets of all types across a person's life span and in both acute and chronic settings.

Standard Dietary Recommendations

Good nutrition is essential to healthy living. A healthy diet is key to obtaining optimal nutrition. Holistic nursing care includes routinely assessing a patient's nutritional status and providing the patient with sound instruction and coaching regarding their dietary needs for optimal nutrition intake. This should occur in all patient care settings. Whether the patient maintains a healthy lifestyle, partakes in unhealthy dietary habits, or has a chronic illness that requires a specialized diet, nutritional health promotion must be made available to all patients. It is essential that nurses understand nutritional principles and be skilled in teaching healthy dietary habits. This section reviews the standards for a healthy diet and discusses MyPlate, an eating strategy designed by the Center for Nutrition Policy and Promotion at the USDA to simplify and standardize dietary eating patterns. Food labels and food safety concerns are also discussed.

Standards for a Healthy Diet

A healthy diet is one that meets the daily recommended intake for macronutrients and micronutrients. Based on the Healthy Eating Index, the USDA recommends the following pattern for dietary intake:

- carbohydrates: 50 to 60 percent of calories per day with less than 10 percent added sugars
- fat: 20 to 30 percent of calories per day with less than 10 percent saturated fat
- protein: 10 to 20 percent of calories per day
- fiber: 25 grams per day
- fluids: 2.5 liters per day

The USDA recommends daily allowances for sodium, calcium, and vitamins D and B12 as well. A healthy diet must take into consideration individual caloric needs. Caloric needs are based on biological sex, age, and activity level. Some diets require strict adherence to the USDA recommendations, including calorie counting; however, the average patient will benefit from teaching related to general principles. Here are some general guidelines for healthy eating:

- Eat a variety of foods, including plenty of vegetables, fruits, and whole grains.
- Choose healthy proteins such as lean meats, fish, poultry, low-fat dairy products, and legumes.
- Drink plenty of water.
- Limit salt, alcohol, saturated and trans fats, and added sugar.
- Eat whole foods as much as possible and avoid highly processed foods.

A healthy diet prioritizes the consumption of sufficient amounts of vegetables and fruits on a daily basis. Vegetables and fruits should be eaten whole whenever possible. There are different categories of vegetables: dark green, red and orange, beans, nuts and seeds (legumes), and starches such as potatoes and cassava. Fruits may be fresh or frozen, canned, or dried. It is best to limit fruit juices, which may be high in calories.

Whole grains are an important part of a healthy diet; they include products made from wheat, rice, or oats that have not been refined. Refined grains, such as white rice and white flour, are grain kernels that have been processed to remove the bran and germ covering of the grain. This refining process removes important nutrients, such as fiber, iron, and vitamins. Whole grains use the entire grain kernel and are more nutritious than refined grains.

Foods that are high in protein include animal products such as seafood, beef, poultry, and eggs, as well as plant-based foods such as beans, peas, seeds, and nuts. Protein choices should be lean and varied. Dairy is a good source of protein, vitamins, and minerals, but low-fat versions of milk, yogurt, and cheese are typically healthier choices. Fats should be limited to 20 to 30 percent of calories, with strict limits on saturated fats. Oils are liquid fats that provide important nutrients. Oils are classified as unsaturated, polyunsaturated, or saturated. A healthy diet will include unsaturated or polyunsaturated fats and limit saturated fats.

Dietary teaching for everyone should focus on developing consistent eating patterns that include healthy amounts of carbohydrates, proteins, fats, and plenty of fresh water. A healthy diet should limit added sugars, saturated fats, sodium, and alcohol. Due to the variety of foods available, dietary choices can easily be adapted to meet cultural, religious, or budgetary preferences.

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 6

Refer back to Unfolding Case Study #3: Part 4 and Unfolding Case Study #3: Part 5 to review the patient data.

Nursing Notes	**1600:** When asked about diet, patient reports eating out for most meals. She states, “I just don’t have time to cook. It’s much easier to grab a burger on the way home. I work crazy hours so by the time I get home, all I want to do is eat my burger and go to bed. No way I could cook after a work shift.”

5. Take action: The nurse prepares to provide education about diet and healthy eating to the patient. What

information should the nurse include in the teaching?

6. Evaluate outcomes: After providing information to the patient about healthy eating, how might the nurse determine that the patient understands the teaching?

MyPlate

MyPlate (Figure 17.5) is a dietary tool developed by the USDA to help individuals maintain healthy eating patterns throughout life. MyPlate uses a 9-inch plate as a visual tool for meeting the USDA's general guidelines. Using the MyPlate method, vegetables and fruits make up half the plate, grains make up roughly a quarter of the plate, and proteins make up the final quarter. A serving of low-fat dairy is included as well. A personalized MyPlate plan is based on age, sex, height, weight, and activity level. The MyPlate website and MyPlate app are available to identify calorie needs and provide simple planning recommendations based on individual needs.

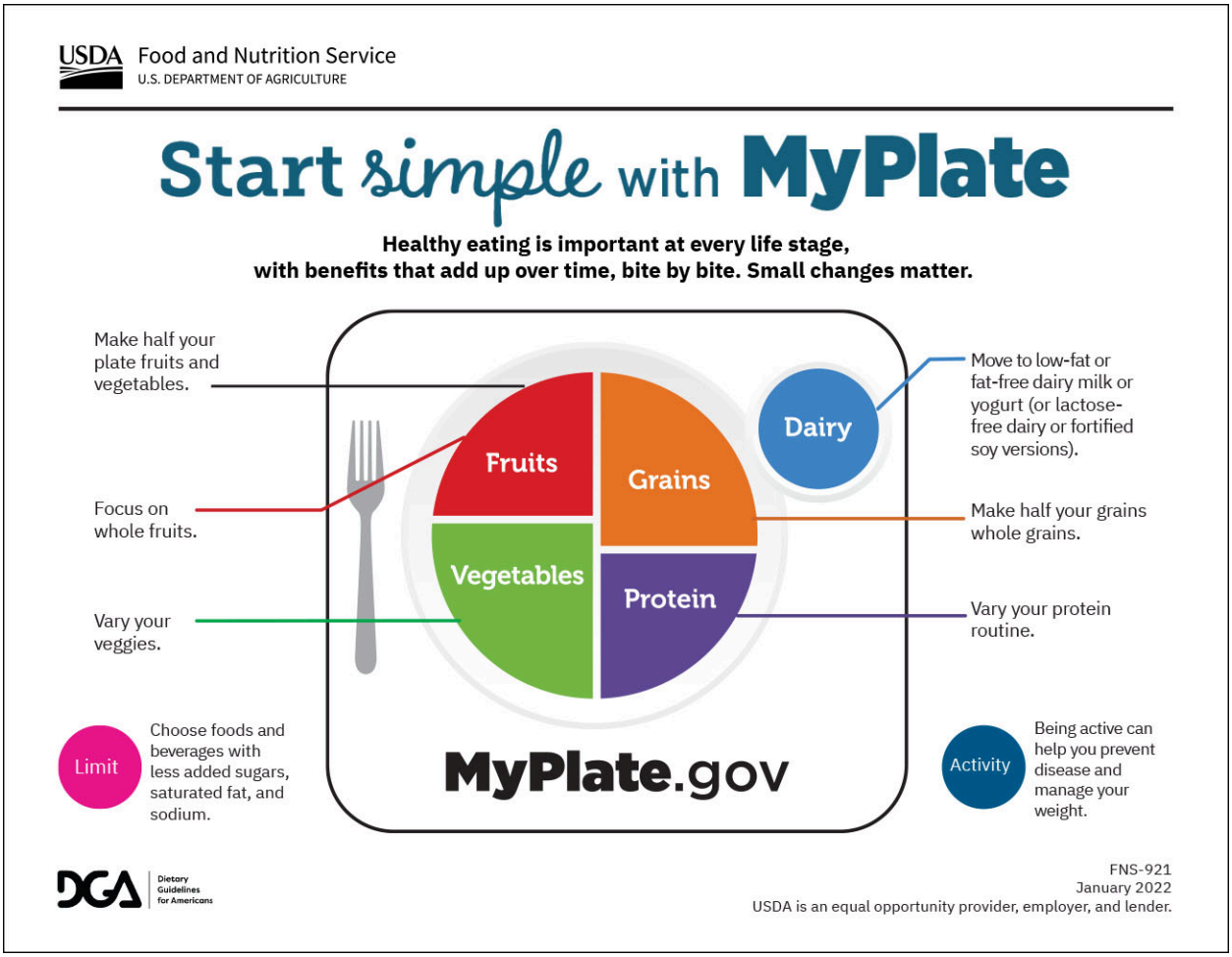

FIGURE 17.5 Through MyPlate, the USDA provides guidance on healthy eating to ensure individuals receive the RDA for each nutrient. (credit: "Start Simple with MyPlate" by U.S. Department of Agriculture, Public Domain)

LINK TO LEARNING

Go to the MyPlate website (https://openstax.org/r/77myplate2) and explore the USDA's recommendations for a nutritious diet.

Food Labeling

Scientists and government agencies have developed food labels to improve decision-making regarding nutrition intake. The USDA Dietary Guidelines provide recommended daily intakes based on DRIs for macronutrients,

micronutrients, and fiber. Food labels report the recommended daily allowances for specific nutrients as a percent daily value per serving. A serving is not a regulated amount but rather a typical volume of food consumed. Food labels always identify the number of servings per container, the number of calories per serving, and the percent daily value per serving for specific nutrients.

LIFE-STAGE CONTEXT

Poor Vision and Reading Labels

The food label is a tool used to educate the public about the nutritional value of a product, but what if a person cannot read the label? It is important to remember that people often develop poor vision as they age. As nurses, we should assess our patients' vision using a Snellen chart to determine the need for a referral for further investigation by an ophthalmologist. We can educate our patients on the use of a handheld magnifier to enhance the print of nutritional labels. We can also encourage them to use the online Myplate.org feature to predetermine which foods to purchase before shopping. Many of the healthier foods such as whole fruits, vegetables, and pure animal protein do not require food labels.

Sometimes, manufacturers will choose to include daily values per container. Labels must include, but are not limited to, the following nutrients: carbohydrates, calcium, iron, potassium, vitamin D, fat, and protein. Fats are broken down into total fat, percent saturated fat, and cholesterol. Carbohydrates are broken down into total carbohydrates, fiber, total sugar, and added sugar. In general, a serving with a percent daily value of 5 percent or less for a nutrient is considered to have a low nutrient value. A serving with a percent daily value of 20 percent or more is considered to have a high nutrient value. A law passed in 2016 required food manufacturers to update their labels. Figure 17.6 details the changes.

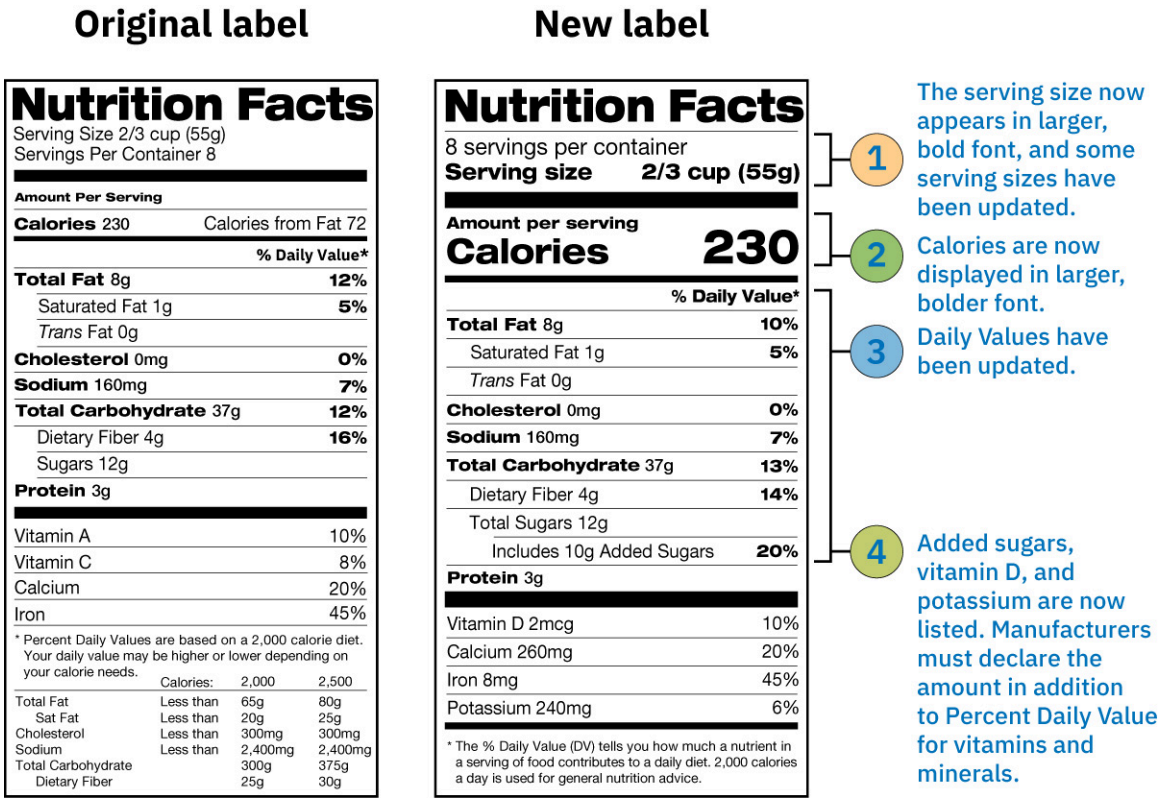

FIGURE 17.6 Updated food labels now list added sugars and potassium, clarify the meaning of percent daily value, and have been reformatted to improve readability. (credit: modification of work "What's on the Nutrition Facts Label?" by U.S. Food and Drug Administration, Public Domain)

LINK TO LEARNING

Food labels have become more sophisticated over the years, incorporating nutrition science in a way that is more relevant and easily accessible. Information on how to understand and use the Nutrition Facts label (https://openstax.org/r/77nutrifacts) is provided by the USDA.

Food Safety

Food safety is an important part of healthy living. The goal of food safety is to prevent foodborne illnesses such as bacterial infections. The following organisms are the cause of most foodborne infections: *Campylobacter*, *Salmonella*, and *Escherichia coli*. Symptoms common to these infections are nausea, vomiting, diarrhea, abdominal pain, and fever. Public health departments have foodborne surveillance programs that include a national reporting system to track outbreaks. *Salmonella*, *Shigella*, and *Listeria* are organisms commonly included in the national reporting system. *Shigella* is a highly contagious intestinal infection. *Listeria* is caused by improper processing or pasteurization and is most harmful to individuals who are pregnant, older, or immunocompromised. Surveillance helps track infections and identify outbreaks for public health intervention.

Prevention is key to food safety and reducing the effects of foodborne illness. Whether food is being prepared in the home, a restaurant, or an institution, the same four principles of food safety apply:

1. Keep hands, utensils, and surfaces clean.
2. Separate raw meat, seafood, and eggs from other foods.
3. Cook foods to the appropriate internal temperature.
4. Chill cooked foods within two hours.

Healthy food practices are essential to good health. Nurses should reinforce these prevention strategies by encouraging good hygiene and appropriate food handling practices and providing resources for patient education.

LINK TO LEARNING

Maintaining safe practices for handling and cooking food is vital for good health. Review the recommendations for food safety (https://openstax.org/r/77foodsaferecs) provided by the CDC. What strategies would you advise for counseling patients about safe eating practices?

Therapeutic Specific Diets

Standard dietary recommendations guide individuals to make nutritious choices, maintain a healthy weight, and reduce the risk of chronic disease. The development of chronic disease affects nutritional goals and complicates nutritional intake. For example, individuals who develop diabetes or heart disease have new nutrient demands depending on the severity of the disease. Someone with diabetes may be advised to maintain stricter calorie or carbohydrate goals, while someone with heart disease will be encouraged to pursue a low-fat, low-sodium dietary pattern. Physiological conditions, such as stroke and reflux disease, can result in difficulty swallowing (dysphagia), requiring changes in food texture. Some disease states and medications can impair nutrient absorption, requiring supplementation of nutrients. Many chronic diseases include specialized diets in the treatment plan. It is important for nurses to know the differences between these diets, know why the specialized diets are ordered, and work closely with dietitians and the clinical team to ensure optimal nutrition outcomes.

Consistent Carbohydrate Diet

Carbohydrates are often misunderstood. Many people limit carbohydrates as a means of calorie control, yet both simple and complex carbohydrates are healthy and important nutrients. There are conditions under which carbohydrates must be controlled, however. An example of a diet focused on carbohydrate control is the consistent carbohydrate diet, which is recommended as a treatment for diabetes. Diabetes is a metabolic disorder affecting the utilization of glucose by the body cells. Poor glucose utilization can lead to acute acid-base disturbances and chronic effects including immune dysfunction, cardiovascular disease, and neurovascular changes. The negative effects of

diabetes can best be prevented by effective blood sugar control.

The consistent carbohydrate diet maintains the recommended amount of carbohydrates per day (40 to 60 percent of the diet) but is designed to meet metabolic goals through the consumption of consistent carbohydrates at each meal. This consistency spreads out the carbohydrates over all daily meals with the goal of maintaining steady glycemic control throughout the day, avoiding hypoglycemic and hyperglycemic blood glucose swings. This mimics the healthy body's natural tendency toward glucose control and insulin release. The consistent carbohydrate diet limits the use of added sugars and encourages healthy carbohydrate choices at each meal. The emphasis is on controlling carbohydrates rather than calories. This diet supports healthy dietary patterns for all individuals, encouraging regular consumption of whole grains, whole fruits and vegetables, and low-fat dairy products, and avoiding added sugars and refined and processed foods.

Fat-Restricted Diet

Twenty to 30 percent of a healthy diet should include fat, an essential, energy-dense macronutrient. Unfortunately, not all fat is considered "good" fat. In general, individuals eating a healthy diet should limit saturated fat to 10 percent of calories consumed. Most saturated fat comes from animal proteins. Because fat is associated with increased risk of obesity, heart disease, hypertension, and stroke, individual treatment plans may include fat-restricted diets to limit risk or decrease disease progression.

Fat-restricted diets adhere to the same USDA recommendations for a healthy diet, which is to consume between 20 and 30 percent of calories as fat but limit the types of fat consumed by avoiding saturated and trans fats. Saturated fat is typically solid at room temperature and is high in cholesterol. High-fat meats, butter, whole milk products, and coconut oil are common saturated fats. Trans fats are artificially produced by a process called hydrogenation. Partially hydrogenated fats are found in processed foods such as cookies, crackers, and margarine spreads. For patients with heart disease or at risk for developing heart disease, the American Heart Association recommends eliminating trans fats and limiting saturated fats to 5 to 6 percent of calories consumed, which is significantly lower than the dietary standard of 10 percent. Substituting more monounsaturated and polyunsaturated fats, such as canola, olive, and corn oils, is a healthy way to obtain needed fat in the diet while reducing the risk associated with "bad" fats.

High-Fiber Diet

Dietary fiber is a type of carbohydrate that adds bulk to aid in digestion. Fiber is found in plant foods and is categorized as soluble or insoluble. A high-fiber diet is recommended for most individuals, as it improves digestive health, aids in weight control, and reduces the risk of colon cancer and other intestinal disorders. Foods high in fiber include whole fruits and vegetables, whole grains, and legumes. High-fiber foods are known to decrease risk of gastrointestinal disorders, cardiovascular disease, and many metabolic disorders and should be included in all healthy diet routines.

Low-Fiber Diet

There are a few conditions that contraindicate a high-fiber diet. Limiting the fibrous content of foods eases digestion. Medical conditions that require periods of gastrointestinal rest benefit from a short-term reduction in fiber intake. Gastrointestinal rest allows for limited stimulation and processing in the intestinal tract, and a low-fiber diet is often included in the treatment plan. Eggs, creamy nut butters, low-fiber whole grain cereals, vegetable and fruit juices, applesauce, and canned fruits and vegetables can be included in a low-fiber diet. This diet should avoid all raw or undercooked vegetables, whole grains, nuts, seeds, and fibrous meats. A low-fiber diet is often used following intestinal surgeries or radiation treatments to the abdomen. Fiber should be slowly added back into the diet as digestive health returns.

Sodium Restriction Diet

The general population should limit sodium intake to less than 2,300 mg/day. Sodium is an essential element needed for many basic physiological processes. Sodium aids in food processing as a flavor enhancer, a curing agent and preservative, and a thickening agent. It also helps regulate the moisture content of food. Because of its versatility, many processed foods are high in sodium content. Unfortunately, high sodium levels increase the risk of cardiovascular disease and hypertension and negatively impact fluid balance within the body. Therefore, sodium-restricted diets are commonly prescribed for individuals with heart disease or at risk for heart disease and chronic fluid retention.

The first step in maintaining a low-sodium diet is to eliminate processed foods from the diet. Eating whole, natural foods keeps the diet naturally low in sodium. Next, all food labels should be carefully monitored for sodium content. Products with less than 200 mg per serving are healthy choices for this diet. Eating a diet high in fresh fruits and vegetables and fresh lean meats, reading food labels, and substituting herbs and spices for added salt are important ways to maintain a low-sodium diet and manage health risks.

Kidney Diet

The kidneys regulate fluid and electrolyte balance in the body. The kidneys are made up of nephrons, which filter the blood to produce urine. A kidney diet is prescribed when kidney function becomes chronically impaired and restricting certain nutrients is necessary to preserve kidney function. Foods high in protein, sodium, and potassium are limited in a kidney diet. Protein metabolism leads to waste products that must be filtered by the kidneys; therefore, a kidney diet will limit protein (animal or plant based) to small portions (2–3 oz). Because water follows sodium in the body, high sodium in the blood can lead to excess fluid volume and increased blood pressure. Because high blood pressure adversely impacts the function of delicate nephrons, sodium restrictions are placed to help preserve kidney function. With advanced kidney disease, phosphorous and potassium are also restricted. While most people on a kidney diet should have 2,000 mL intake of fluid daily, in advanced disease fluid may be restricted even further based on individual need. Routine lab work is required to monitor kidney function, fluid status, and electrolytes.

High-Calorie, High-Protein Diet

A high-calorie, high-protein diet may be prescribed when there is a need for extra nutrition to aid healing. Individuals with extensive burns or poor healing wounds may be placed on a diet rich in quality proteins, providing needed energy and nutrients to speed healing and tissue repair. This diet minimizes carbohydrate intake and increases protein intake. Proteins with high amounts of saturated fats should be avoided. Egg whites, fish, fowl, dairy, and legumes are excellent protein choices. Avocados, cheese, nuts, and dried fruit make excellent calorie-dense snack choices. Weight trends must be closely monitored; also, because high protein levels can negatively impact kidney function, kidney labs must be routinely followed.

Consistency Modification Diets

Some diets are designed to alter the texture and consistency of foods rather than the nutritional content. Anatomical abnormalities, such as cleft palates, may prevent normal mastication. Neurological dysfunction can impede swallow reflexes. Gastroesophageal reflux disease can cause esophageal strictures that can cause dysphagia (difficulty swallowing). These conditions often require changes in food texture to improve nutritional access and decrease the risk of aspiration of food particles into the lungs. Typically, a speech pathologist will make recommendations to the clinical team regarding the need for modified diets based on the results of swallow studies. Nurses must collaborate with the whole clinical team, as they are responsible for managing the dietary intake of patients on modified diets. It is essential to understand, maintain, and monitor outcomes for all patients on modified diets.

Liquid Diet

Liquid diets are used to meet short-term clinical goals. Liquids are classified by the consistency of the fluid. Clear liquids melt to a transparent fluid that contains no pulp. A full liquid is a fluid that contains sufficient residue but still maintains a fluid form. Sometimes the consistency of liquids is restricted based on viscosity. Liquid diets are implemented for a variety of reasons and are often an essential part of the treatment plan.

Clear Liquid

A clear liquid diet is often used as short-term treatment with specific clinical goals. Clear liquids are necessary before and after certain medical procedures (including after surgery) and for patients who need to rest their bowels or replace fluid and electrolytes, for example, due to severe diarrhea. This is not a diet that can be maintained long term because it has little nutritional value. A clear liquid diet includes transparent liquids with minimal residue. This includes broths, tea, clear juices, clear gelatin, popsicles, and sport drinks. The liquids cannot contain any pulp or substance.

Clear liquids can be thickened to improve the consistency for individuals who aspirate on thin liquids. A thickening agent is added to the clear liquid to increase the viscosity, allowing for the thickened liquids to move more slowly

and improve swallowing. The viscosity can be varied as needed. Common consistencies include nectar thick, honey thick, or pudding thick. Nurses often collaborate with speech pathologists when thickened liquids are being considered.

Full Liquid

A full liquid diet contains residue and is not transparent. It includes foods that become liquid at room temperature. While it contains a sufficient amount of nutrition, it can be difficult to meet daily nutritional needs and should only be used short term. Full liquid diets include cream soups, ice cream, pudding, and juices with pulp. A full liquid diet is part of the treatment plan when restarting oral feeding following a period of enteral or parenteral feeding or for short-term care when a patient is unable to tolerate a mechanical soft diet.

Soft Diets

Soft diets are diets in which the consistency and texture of the food are manipulated to improve swallowing or digestion. These diets typically contain lower fiber (less than 2 grams per serving) and a soft texture. They exclude fibrous meats, raw vegetables and fruits, beans, shellfish, and whole grains. The texture is dependent on the specific impairment. Soft diets are often used for patients with some degree of dysphagia or for postsurgical care.

Mechanical Soft

A mechanical soft diet is most often used with individuals who have a chewing or swallowing deficit. This is commonly seen in patients with dysphagia or dental impairment. The food is processed to a soft texture. Vegetables and meats should be tender, well cooked, and chopped or ground to the texture of mashed potatoes. Eggs, white rice and pasta, applesauce, and dairy products work well in a mechanical soft diet. Teaching patients to chew slowly and thoroughly and to ingest frequent small meals is helpful.

Pureed Diet

Pureed diets are processed to a smooth liquid consistency. Unlike a full liquid diet, pureed foods can come from a variety of sources, though it is best to avoid nuts and raw fruits and vegetables. It is best to puree foods separately. A pureed diet is prescribed for patients with an inability to chew and for some types of dysphagia. It is typically used for a short-term period following acute illness or injury but may be used for the long term when dysphagia cannot be resolved or when frailty or dementia limit nutritional intake at the end of life.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Assisting a Patient with Eating

See the competency checklist for Assisting a Patient with Eating. You can find the checklists on the Student resources tab of your book page on openstax.org.

Enteral Nutrition

An alternate form of nutrition, **enteral nutrition**, utilizes a tube or catheter for administration. Enteral feedings are liquid and come in a variety of formulas to meet specific needs. These feedings are prescribed for individuals who have lost the ability to ingest food orally but who otherwise have a functioning digestive tract, capable of absorption and digestion of nutrients. Enteral nutrition typically has two routes of administration: nasogastric (NG) tube and percutaneous enteral gastrostomy (PEG) tube. Care of the patient on enteral feedings requires the expertise of an interdisciplinary team. Nurses are integral members of the enteral nutrition team and must be skilled in the administration, management, and evaluation of nutritional status when enteral nutrition is prescribed. Figure 17.7 shows the different access points for enteral tubes.

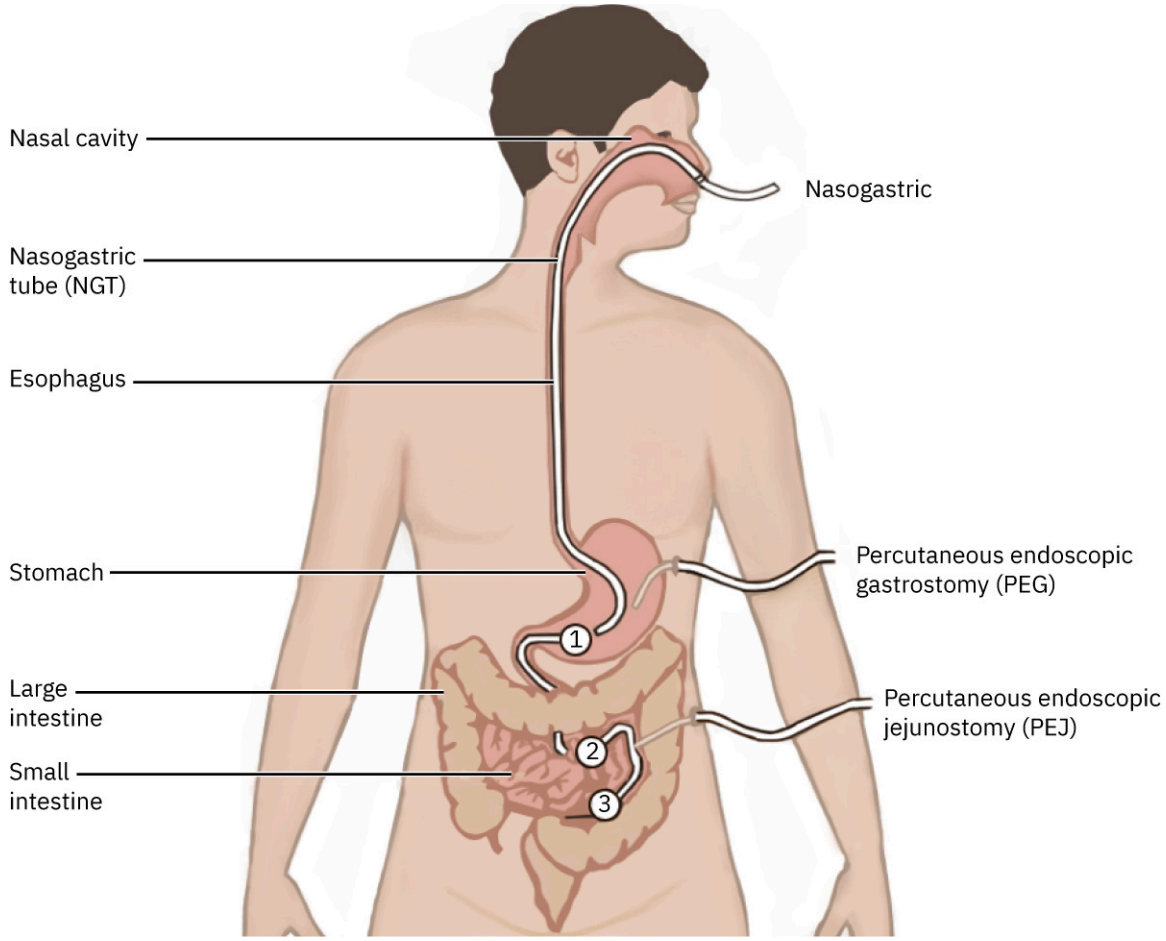

FIGURE 17.7 An enteral tube can access the digestive system via the nose or the abdomen. (credit: modification of work "Figure 14.12 Enteral Tube Access" by Open Resources for Nursing (Open RN), CC BY 4.0)

Nasogastric and Orogastric Tubes

NG tubes are sometimes placed when food cannot be safely ingested. They are utilized for the short term only, typically less than four weeks. The NG tube is a single- or double-lumen tube that is passed through the nares, pharynx, and esophagus and into the stomach; it can be used for suctioning stomach contents and administering medications in addition to providing enteral nutrition. Orogastric (OG) tubes work in the same manner except they are inserted through the mouth into the esophagus and then into the stomach. OG tubes are typically used with mechanically intubated and sedated patients and should never be used in conscious patients because they can induce a gag reflex and cause vomiting.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering a Tube Feeding

See the competency checklist for Administering a Tube Feeding. You can find the checklists on the Student resources tab of your book page on openstax.org.

Percutaneous Enteral Gastrostomy Tube

A PEG tube is placed directly through the abdominal wall via endoscopy. The PEG tube is placed in the stomach for direct administration of formula feeds and medications. In some situations, the tube can be advanced through the gastric pouch into the proximal part of the small intestine (jejunostomy). PEG tubes and jejunostomies are utilized when alternative nutrition is needed long term. PEG tubes may also be used when there is an obstruction to the esophagus, or the esophagus has been removed. Percutaneous endoscopic jejunostomy (PEJ) tubes are inserted through the abdominal wall directly into the jejunum, bypassing the esophagus and stomach. PEJ tubes are used

when all or part of the stomach has been removed or if the provider determines PEJ placement would best suit the patient's needs.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Caring for a Gastrostomy Tube

See the competency checklist for Caring for a Gastrostomy Tube. You can find the checklists on the Student resources tab of your book page on openstax.org.

Nursing Considerations for Administration

Nursing considerations for enteral nutrition involve management of care concerning placement and maintenance of the tube, administration of formula feeds and medications, and prevention and monitoring of complications. Care is dependent on the type of tube being used and the underlying medical conditions of the patient.

REAL RN STORIES

Communicating about NG Tube Insertion
Nurse: Rosa, BSN
Clinical setting: ICU
Years in practice: 1
Facility location: Vermont

I was caring for a patient who had been in an automobile accident where he sustained multiple injuries all over his body, including an injury to his mouth and jaw. His eyes were swollen shut, and he was rarely conscious. The last nurse attempted to insert the NG tube twice, but both times, Mr. Zhu resisted by twisting and turning his head and pulling it out with his hands. During report, my supervisor told me that in order to insert the tube, I might need to increase Mr. Zhu's sedation or request for an order for wrist restraints. I considered all of these options and decided to try another way. I gathered the supplies and approached Mr. Zhu's room. I knocked on the door and began talking to Mr. Zhu, even though he seemed unconscious and unaware of my presence. I told him who I was and why I was there, and I let him know where I was going to touch him to do his assessment and care. Then, I explained that he had an injury to his mouth and jaw. These injuries meant that he could not chew his food or have anything in his mouth for a while. In order to give him nutrition, he needed a tube from his nose to his stomach. This was better for him than any other option right now. I told him it would be uncomfortable but quick. Mr. Zhu did not move or indicate understanding of what I told him. However, when I began to insert the NG tube, it went in smoothly, and Mr. Zhu did not resist. Once I was finished, I thanked Mr. Zhu and told him that I had secured the tube so that it would not be pulled out and he would not have to have it reinserted again. I thanked him again and exited the room.

An NG tube can be placed by a nurse but requires a clinician's order. Once placed, the NG tube is anchored to the nose or cheek, and the length of the external tubing is documented. Placement must be verified via x-ray imaging prior to use. A PEG tube or jejunostomy is placed by a physician via endoscopic procedure. Placement is also verified by x-ray imaging prior to use. The placement of NG and PEG tubes must be verified prior to every subsequent use, per facility protocol. The tubing is monitored for migration every shift and with every use. If placement of the tube is in question, gastric contents can be aspirated and their pH tested for appropriate acidity. Follow-up x-rays can be ordered for reevaluation of placement if needed. Incorrect placement can lead to aspiration or perforation.

The registered dietitian determines the type of formula needed following patient assessment. The nurse administers the enteral feeding as prescribed. Enteral nutrition can be administered via bolus or pump with a set volume and rate of administration. Free water flushes are commonly administered prior to and following administration or in tandem with an enteral feeding pump. Tubing should be assessed for migration and obstructions with every formula feed. The nurse should monitor for leakage and skin breakdown. The tubing should be cleansed routinely according to facility protocol, typically using water or saline and soft gauze. Any redness or purulent drainage should be documented and reported.

Enteral feedings are associated with complications. It is the nurse's responsibility to mitigate these types of risk:

- To reduce the risk of aspiration,
  - maintain slow, steady administration rates;
  - keep the patient's head of bed elevated 30° to 45° as tolerated;
  - monitor for migration of visible NG/OG tubing; and
  - assess for residual gastric contents and follow facility policy for rate reduction protocols.
- To reduce the risk of clogged tubing,
  - flush the tube with water every shift and prn (as needed),
  - flush tubes before and after administration of feedings or medication,
  - assess for any residual gastric contents and follow facility policy for rate reduction protocol, and
  - irrigate tubing per facility protocol.
- To reduce the risk of gastric distress,
  - administer feedings at room temperature;
  - maintain prescribed rate of administration;
  - assess placement every shift and prior to feeding or medication administration; and
  - assess for signs of gastric distress including nausea, diarrhea, abdominal pain, and distension.

Parenteral Nutrition

A form of alternative nutrition is **parenteral nutrition (PN)**, in which a nutrient formula is administered intravenously. PN has a high osmolality and causes irritation to veins, so it should always be administered through a central venous catheter. A central venous catheter provides intravenous access directly to the vena cava, which empties into the heart. PN is reserved for individuals who do not have a functional gastrointestinal tract. This includes children with congenital gastrointestinal malformations, individuals with severe ulcerative colitis or bowel obstruction, and those who are critically ill with organ failure. The formula is composed of macronutrients and micronutrients. The three major macronutrients are dextrose (a form of glucose), proteins, and fat (lipid) emulsions. Vitamins, trace minerals, and electrolytes are also added. There are two types of PN: peripheral parenteral nutrition (PPN) and total parenteral nutrition (TPN).

Types of Parenteral Nutrition

PN requires central venous access. A central venous catheter is inserted in the jugular or subclavian vein and terminates in the vena cava. Central lines can be tunneled for long-term use (months to years) or nontunneled for intermittent use. Peripherally inserted central catheter (PICC) lines are long catheters inserted through a vein in the arm. Commonly, the basilic vein is used, terminating in the superior vena cava. PICC lines are used for intermediate use, typically weeks to months. Standards of care must be followed to reduce complication rates and improve patient outcomes. Policies regarding the care and use of central lines should follow facility protocols.

Peripheral Parenteral Nutrition

PPN is administered through a PICC line using a pump. PPN is intended for short-term use, typically less than ten days. The peripheral insertion reduces risk and irritation by limiting osmolality, which can lead to higher volume per feeding. Care of the PICC line should follow standard guidelines and facility protocols.

Total Parenteral Nutrition

TPN is administered through a central venous catheter. TPN is administered when the gastrointestinal tract is not functional or when the patient needs to rest their bowels. Energy and nutrient needs are calculated based on individual need and body weight. Nutrients include amino acids, fatty acids, vitamins, minerals, and electrolytes. Carbohydrates are provided as dextrose. Lipid emulsions are often administered separately. In recent years, the use of three-in-one admixtures, which are composed of dextrose, proteins, and lipid emulsions, has improved patient care by streamlining TPN administration and reducing complications.

TPN is administered through a central line into the vena cava of the heart for long-term access. Close monitoring is required whenever a patient is receiving TPN. Weight, intake and output, and blood glucose must be monitored carefully. Bloodwork must be evaluated and documented to follow trends involving complete blood count, electrolytes and blood urea nitrogen (BUN), prealbumin, and albumin. Complications associated with TPN include central line infections, fluid volume overload, glucose and electrolyte disturbances, and liver and gallbladder

dysfunction.

Nursing Considerations for Administration

Nursing considerations related to PN include catheter care, administration of parenteral nutrition (PN), preventing and responding to complications, and ongoing assessment of nutritional status. Nurses should follow these guidelines for central line care and administration of PN:

- PICC dressings should be changed every seventy-two hours using sterile technique.
- PN should be administered through a dedicated lumen.
- Parenteral tubing should be changed every twenty-four hours.
- The PN label should be verified against the documented order.

Complications associated with PN include central line infections, sepsis, poor blood sugar control, hepatic dysfunction, and fluid and electrolyte imbalance. Nursing interventions should be geared toward prevention:

- Maintain strict sterile technique for central line care.
- Monitor vital signs routinely.
- Monitor blood sugar and administer insulin per protocol.
- Assess for fluid imbalance.
- Monitor labs for trends involving electrolytes, kidney, and liver function.

17.4 Nutritional Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe steps of the nursing assessment for nutritional status
- Understand diagnostic testing for nutritional assessment
- Recall conditions causing imbalanced nutritional status

Nutritional assessment is an important skill in nursing. The assessment begins with the gathering of subjective data, focusing on individual lifestyle behaviors and underlying medical conditions. A thorough health history is vital. The nurse must also collect physical cues that help determine overall nutritional status and trends. These include anthropometric measures such as BMI and growth charts. Weight trends are vitally important, as are underlying conditions that affect the digestion, absorption, and metabolism of nutrients. Lab work helps confirm and prioritize nutritional concerns and hydration status. Last, the results from pertinent diagnostic tests, such as swallow studies and x-rays, should be reviewed and recorded. Once all data are collected, the nurse can analyze both subjective and objective cues and develop a prioritized plan of care that is individualized for the patient.

This section describes the steps of a nutrition assessment and discusses specific medical conditions associated with impaired nutrition. Because many conditions impact nutritional status, it is important for the nurse to understand the physiological adaptation that occurs with a given health condition and anticipate the nutritional needs required to restore homeostasis. Having a sound understanding of how nutrition impacts the human body is an essential aspect of nursing care.

Nursing Assessment for Nutritional Status

A thorough nursing nutrition assessment is foundational to the holistic care of all patients. A nutrition assessment includes subjective data, including demographic and sociocultural data, lifestyle cues, and medical history. It also includes objective data gathered from physical exams, labs, and diagnostic tests. The physical exam should focus on data from anthropometric measures (such as height, weight, and BMI), skin integrity, and gastrointestinal and urinary functions. Lab trends must be noted and results from pertinent diagnostic tests documented if indicated. When conducting a nutrition assessment, it is vital to know the overall state of health, including all chronic diseases, and to allow this holistic understanding to guide critical thinking, especially those disease states that promote the greatest risk in association with malnutrition or chronic disease progression.

Collecting Subjective Data

A thorough health history provides needed subjective data to guide nutritional planning and intervention (as discussed in Chapter 4 Obtaining a Complete Health History). A health history begins with demographic data, which

are important when considering nutritional status as nutrient needs differ based on biological sex and age. Sociocultural factors have a significant effect on access and food choice. The patient's religious preference, ethnicity and culture, educational level, occupation, and geographic location should all be documented as they impact overall health and nutritional status. Support systems, including food assistance programs and weight control support groups, should be reviewed.

A thorough discussion of dietary patterns and lifestyle behaviors is essential. Dietary patterns can be assessed using a variety of patient-friendly tools. A twenty-four-hour food recall is a simple measure to gauge usual daily food intake. A three-day food tracker is an even better measure, as it helps identify eating patterns and trends. There are a variety of apps and website food trackers that provide a structured way to document and review intake over time. The health history should reflect usual dietary patterns and include information related to food access or food insecurity, food shopping trends, utilization of food assistance programs, and attitudes toward cooking and food preparation.

In addition to dietary patterns, lifestyle behaviors must be reviewed and documented. Assessment of activity levels or levels of assistance needed with activities of daily living is vital to understanding caloric and nutritional needs as well as barriers to care. Utilization of health tracker apps with activity logs and stress level recordings can be insightful. Document any sensory impairment (vision or taste) that impacts activity or affects the ability to shop or cook safely. Ask about smoking history and use of alcohol or illicit drugs.

Identify past medical history that impacts nutritional health. Ask about weight trends and whether there is a history of dieting, utilization of weight loss programs, or bariatric surgery. Medical conditions to note include gastrointestinal disease, food allergies, history of diabetes, heart disease, liver disease, history of chemotherapy or radiation, and mental illness. Document if there is a family history of diabetes, heart disease, or obesity. Review all medications and discuss any medication effects on nutrition or hydration status.

Last, allow time to discuss the patient's current health concerns. These include unintentional weight loss, weight gain, change in appetite, difficulty chewing or swallowing, nausea, vomiting, stool changes, and abdominal pain. Discuss current life stressors (divorce, unemployment, recent hospitalization) that present as obstacles to a healthy lifestyle. Explore attitudes toward healthy eating and assist the patient in identifying barriers to healthy living. All documentation must be accurate and professional, devoid of any bias or personal opinion.

Collecting Objective Data

The physical exam begins with assessment of vital signs, height, and weight. Compare findings to those previously documented, if available. Complete a head-to-toe assessment, emphasizing systems that relate to nutritional status (Table 17.7).

Category	Areas to Assess
General	Body frame, hygiene, coordination, adequate vision and hearing, dentition
Mentation	Orientation, alertness, ability to converse and follow commands, mood stability
Skin	Turgor, pallor, cyanosis, nonhealing wounds, bruising or bleeding, edema, condition of hair and nails
Gastrointestinal/ genitourinary	Abdominal girth, abdominal distension, epigastric or abdominal tenderness, ascites, bladder distension, urine output
Musculoskeletal	Muscle tone and strength, gait

TABLE 17.7 Objective Data for a Nutritional Status Assessment

Category	Areas to Assess
Anthropometric measures	BMI, waist circumference, skinfold test
Other	Presence of enteral tubes, twenty-four-hour intake and output

TABLE 17.7 Objective Data for a Nutritional Status Assessment

Diagnostic Tests for Nutritional Status

There are several diagnostic procedures specific to nutrition. Imaging studies include routine x-rays used to verify placement of NG and PEG tubes. Computed tomography scans can identify anatomical anomalies, such as intestinal blockages and tumors. A dual-energy x-ray absorptiometry (DEXA) scan is a bone density test performed under low-dose x-ray. The DEXA is a measure of calcium and other mineral deposits that provide a relative measure of bone strength. A **modified barium swallow study (MBSS)** views the anatomical and swallowing physiology of a bolus of food under video fluoroscopy. The MBSS allows for real-time evaluation of swallowing function and safety under the guidance of a speech-language pathologist.

An **esophageal duodenostomy (EGD)** is an invasive procedure performed under anesthesia. During an EGD, an endoscopic tube is advanced through the pharynx, esophagus, and gastric pouch to check for anomalies such as esophageal strictures and peptic ulcers. In some cases, an upper-gastrointestinal endoscopy can advance into the upper jejunum and obtain a biopsy of the intestinal wall to identify celiac disease.

Laboratory Tests

Diagnostic and lab work results can provide important clues about a patient's overall nutritional status and should be used in conjunction with a thorough subjective and objective assessment to provide an accurate picture of the patient's overall health status. Common lab tests include hemoglobin (hgb), hematocrit (HCT), white blood cell (WBC) count, albumin, prealbumin, and transferrin.

Anemia is a medical condition diagnosed by low hemoglobin levels. Hemoglobin is important for oxygen transport throughout the body. Anemia can be caused acutely by hemorrhage, but it is often the result of chronic iron deficiency, vitamin B12 deficiency, or folate deficiency. Iron supplements, vitamin B12 injections, folate supplements, and increased iron or folate intake in the diet can help increase hemoglobin levels.

Albumin and prealbumin are proteins in the bloodstream. They maintain oncotic pressure so that fluid does not leak out of blood vessels into the extravascular space. The most abundant protein circulating in the blood is **albumin**, which is used as a marker for protein status. Albumin and prealbumin levels are used as markers of malnutrition, but these levels can also be affected by medical conditions such as liver failure, kidney failure, inflammation, and zinc deficiency. Low albumin levels can indicate prolonged protein deficiency intake over several weeks, whereas prealbumin levels reflect protein intake over the previous few weeks. For this reason, prealbumin is often used to monitor the effectiveness of PN therapy.

Transferrin is a protein required for iron transport on red blood cells. Transferrin levels increase during iron deficiency anemia and decrease with kidney or liver failure and infection.

A patient's amount of muscle wasting due to malnutrition is measured by a twenty-four-hour urine creatinine level (Hood, 2020). If insufficient calories are consumed, the body begins to break down its own tissues in a process called catabolism. BUN and creatinine are released as a by-product. A twenty-four-hour urine collection measures these by-product levels to assess the degree of catabolism occurring.

WBCs will decrease with malnourishment, specifically with protein and vitamins C, D, and E and B-complex deficiencies. Low WBCs place the patient at risk for infection because adequate WBCs are necessary for a fully functioning immune system. See Table 17.8 for a description of selected lab values associated with nutritional status. As always, refer to facility lab reference ranges when providing patient care.

Lab	Normal Range	Nursing Considerations*
Hemoglobin (hgb)	Females: 12–16 g/dL Males: 14–17.4 g/dL	Hemoglobin measures the oxygen-carrying capacity of blood. Decreased levels occur due to hemorrhage or deficiencies in iron, folate, or vitamin B12. **10–14: mild anemia** **6–10: moderate anemia** **<6: severe anemia**
Hematocrit (HCT)	37–50 percent	Hematocrit is normally three times the patient's hemoglobin level during normal fluid status. Increased levels occur with dehydration, and decreased levels occur with fluid overload or hemorrhage.
White blood cells (WBCs)	5,000–10,000 mm^3	Increased levels occur due to infection. Decreased levels occur due to prolonged stress, poor nutrition, and vitamins C, D, and E and B-complex deficiencies. **<4,000: at risk for infection or sepsis** **>11,000: infection present**
Magnesium	1.6–2.6 mEq/L	Decreased level with poor nutrition or alcohol misuse. Increased levels due to kidney dysfunction. Critical values can cause cardiac complications: **<1.2 mg/dL or >4.9 mg/dL**
Albumin	3.4–5.4 g/dL	Increased with dehydration. Decreased level due to zinc deficiency, corticosteroid use, protein deficiency over several weeks, or conditions resulting in muscle wasting/muscle loss.
Prealbumin	15–36 mg/dL	Increased levels with corticosteroid or contraceptive use. Decreased levels due to inflammation, poor immunity, protein depletion over a few weeks.
Transferrin	250–450 mcg/dL	Increased levels due to dehydration and iron deficiency. Decreased levels due to anemia; vitamin B12, folate, and zinc deficiency; protein depletion; and conditions resulting in muscle wasting/muscle loss.
24-hour urine creatinine	Males: 0.8–1.8 g/24 hours Females: 0.6–1.6 g/24 hour	Increased levels with kidney disease and muscle breakdown. Decreased levels with progressive malnutrition as muscles atrophy.

*Bolded items are critical conditions and require immediate healthcare provider notification.

TABLE 17.8 Selected Lab Values Associated with Nutritional Status

Conditions Causing Imbalanced Nutritional Status

Every cell in the body is affected by nutrition. Nutrient deficiencies and excesses affect every body system. Some disease states cause nutritional imbalances, while others result from a nutritional imbalance. Disease states that affect metabolic rates result in significant physiological compromise and increase the risk of developing chronic disease. Infections, inflammatory disease, metabolic conditions, and eating disorders are all medical conditions that have a direct effect on nutritional status. This section reviews the effects that infections, inflammatory disease, metabolic conditions, and eating disorders have on nutritional status.

Infections

Infectious organisms in the body increase demand for energy. Healing from an infectious disease occurs when metabolic conditions allow the immune system to control and limit the effects of the disease. Healing is compromised when nutritional deficits are present, preventing immune-modulating cells from functioning properly. Foodborne organisms can cause infection when hygiene and safety standards are not followed. Viruses, bacteria, and protozoa are all organisms that can create an infectious state.

In some cases, chronic infections can develop, stressing the nutritional demands of the body. Chronic infections commonly occur in the urinary tract, in chronic wounds, and in both the upper and lower respiratory tracts. When increased nutritional demands are not met, the patient's nutritional status becomes compromised, and the body is unable to overcome the infectious agent. Chronic infectious states often benefit from a high-calorie, high-protein diet to meet elevated energy demands.

Inflammatory Diseases

Inflammatory disease occurs when the body's natural defenses are hyperreactive and cause damage to tissues. Inflammation is caused by organisms, injuries, and toxins in the environment. Inflammatory disease affects every body system and is a driving force for malnutrition. Inflammation can decrease appetite and lead to decreased dietary intake and anorexia. It can cause catabolic metabolism of muscle tissue, reduce insulin sensitivity of body cells, and impair nutrient absorption. Food allergies, Crohn disease, and celiac disease are all associated with inflammatory processes. Many chronic illness states have an inflammatory component. This often presents as low-grade inflammation and leads to unintentional weight loss, decreased muscle mass, and poor quality of life. Heart disease, chronic obstructive pulmonary disease, and rheumatoid arthritis are examples of chronic disease states associated with low-grade inflammation.

Metabolic Conditions

Metabolic conditions are multifocal and associated with digestive dysfunction, malabsorption, and poor utilization of nutrients. Disorders that result in poor digestion include cognitive dysfunction, dysphagia, and mental illness that leads to poor dietary intake. Acute gastrointestinal distress (nausea, vomiting, and diarrhea) can interfere with intake and digestion. Poor digestion and decreased intake over time lead to malnutrition. Some disorders affect the absorption of nutrients within the small intestines. Bowel obstructions, diabetes, pernicious anemia, cystic fibrosis, and celiac disease cause malabsorption leading to nutrient deficits. Some diseases affect the metabolic rate, such as thyroid disease. An overactive thyroid can lead to a hypermetabolic state, while an underactive thyroid can lead to a hypoactive metabolic rate. It is important to review every patient's medical history and identify medical conditions and treatments that have a direct effect on nutritional status.

Metabolic abnormalities can be risk factors for heart disease, diabetes, and stroke. Metabolic syndrome is a cluster of conditions known to increase risk of chronic disease when presented together; it is characterized by abdominal obesity, elevated lipid levels, elevated blood glucose, and elevated blood pressure. When three of these four symptoms are present, the individual is considered to be at metabolic risk. Fortunately, metabolic syndrome can be reversed with consistent lifestyle changes, including healthy dietary patterns of eating and increased physical activity, thereby decreasing overall health risks.

Eating Disorders

Eating disorders are often associated with maladaptive coping skills. Anorexia nervosa and bulimia are two diseases that have direct effects on patient nutrition. Patients who have anorexia nervosa are very focused on their weight to the point that they obsess about their diet. They will appear underweight and have great fear about gaining weight. Bulimic patients will eat in secret and then engage in self-induced vomiting to get rid of the food they ate. It is a cycle of secret binging, shame, and then self-induced vomiting called purging. It is episodic but recurrent. Patients with bulimia typically maintain weight but suffer from dental caries due to loss of tooth enamel. They also have menstrual irregularities and electrolyte imbalances as a result of persistent purging and laxative overuse. Both anorexia and bulimia can have severe consequences on the patient's physical, mental health, and self-image.

LIFE-STAGE CONTEXT

Eating Disorders in Young Adults

While eating disorders can affect all people, they are more common in females between the ages of 12 and 35 years. Research has indicated that eating disorders among teens have doubled since the pandemic. Increased social media use has been linked to higher incidences of body dysmorphia and eating disorders in adolescents and young adults (Harriger et al., 2022).

Eating disorders can lead to physiological complications and are often accompanied by anxiety and guilt. Anorexia nervosa is a life-threatening body image disturbance that results in a state of emaciation. Anorexia is often associated with control and an intense fear of becoming obese. Bulimia is a compulsive eating disorder associated with binge eating followed by purging. It is episodic but recurrent. Patients with bulimia typically maintain weight but suffer from dental caries due to loss of tooth enamel, menstrual irregularities, and electrolyte disturbances as a result of persistent purging (forced vomiting and laxative overuse).

Eating disorders are complex and require the nurse to consider both physiological and psychological stressors in the body. Nursing care is prioritized according to safety needs and risk reduction. Maladaptive eating patterns often accompany stress, anxiety, and depression. It is important to analyze underlying stressors and utilize physiological and psychological interventions when caring for all patients with eating disorders.

Summary

17.1 Nutritional Concepts

Good nutrition includes ingestion of quality macronutrients such as carbohydrates, proteins, and fats. These provide adequate calories to meet the body's daily energy needs. Dietary patterns also need to include adequate water regulation to maintain hydration balance and sufficient quantities of micronutrients, like vitamins and minerals, to meet metabolic demands. Weight and BMI trends help track growth and development and identify early risks to nutritional health. Understanding the role of nutrition in the daily health and wellness needs of people across their life span is key to the achievement of optimal nutrition and health.

17.2 Factors Affecting Nutrition

Physiological and psychological factors significantly affect nutritional status. Physiological factors affecting nutrition include basic human factors such as age, developmental stage and activity level, biological sex, physical health, and the presence of chronic disease, pregnancy, or lactation. Physiological factors also include environmental factors such as socioeconomic status, food insecurity, and lifestyle behaviors. Psychosocial factors are highly influential because mealtimes in all cultures tend to be social events, giving food meaning beyond basic nutritional need. This meaning can be positive, connected with celebrations and traditions, but it can also result in emotional eating that leads to negative health outcomes. It is important to take a holistic view when analyzing patient cues related to nutritional status.

17.3 Specialized Diets

A healthy diet includes quality nutrients such as carbohydrates, proteins, fats, vitamins, and minerals, all in sufficient amounts to meet individual needs. Nutritional teaching should address food safety, food label reading, and healthy eating strategies, for example, by utilizing the MyPlate.gov tool. Specialized diets may be implemented to reduce health risks or optimize nutrition during acute or chronic illness. Common specialized diets include the consistent carbohydrate diet, restricted fat diet, low-sodium diet, and high-fiber diet. Kidney diets, low-fiber diets, and high-calorie, high-protein diets are less common but extremely useful in certain medical conditions. Some specialized diets modify the consistency of the food for improved consumption and/or digestion. These include the mechanical soft diet, pureed diets, and various liquid diets. Enteral nutrition and PN require strict nursing care to provide controlled nutritional intake via enteral tubes such as the NG, OG, and PEG or via central lines like PPN and TPN.

17.4 Nutritional Assessment

A nutrition assessment begins with a collection of subjective data, including a history of weight trends, nutrition intake, lifestyle behaviors, demographics, and past medical history. Objective data should include anthropometric measures and a focused physical assessment. Diagnostic and lab work results can provide important clues about a patient's overall nutritional status and should be used in conjunction with a thorough subjective and objective assessment to provide an accurate picture of the patient's overall health status. Common lab tests include hgb, HCT, WBC count, albumin, prealbumin, and transferrin.

Infections, inflammatory disease, metabolic conditions, and eating disorders are all medical conditions that have a direct effect on nutritional status. It is important to review every patient's medical history and identify medical conditions and treatments that have a direct effect on nutritional status. Analyzing underlying stressors and utilizing physiological and psychological interventions are important when caring for all patients with eating disorders.

Key Terms

albumin the most abundant protein circulating in the blood, with many functions within the body; used as a marker for protein status

body image perception a person has about their physical body, including any feelings associated with that perception

body mass index (BMI) a value that is calculated from an individual's height and weight to provide as measurement relative to the standards for ideal body weight

calorie a unit measure of energy

carbohydrate macronutrient used to fuel the immediate energy needs of the body
cellular respiration the breakdown of energy-rich nutrients (carbohydrates, fats, and proteins) to provide ATP, which fuels cellular functions within the body
dehydration a fluid volume deficit that occurs with inadequate water intake or excessive water loss or both
Dietary Reference Intake (DRI) scientifically developed values for essential nutrients and other food components
enteral nutrition nutrition that is directly administered into the stomach
esophageal duodenostomy (EGD) an invasive procedure performed under anesthesia in which an endoscopic tube is advanced through the pharynx, esophagus, and gastric pouch to check for anomalies such as esophageal strictures and peptic ulcers
fat large, complex molecule made up of fatty acids and glycerol
food desert a geographical area where fresh produce and foodstuffs are either too expensive or unavailable
food insecurity the state of having limited access to adequate food
ideal body weight (IBW) weight at which a person maintains optimal health benefits
macronutrient nutrient consumed in large quantities to meet the body's energy needs
malnutrition an imbalance between the nutrients consumed and nutrients needed; includes both undernutrition and overnutrition and involves both macronutrients and micronutrients
metabolism the process by which substances are chemically broken down to meet the body's nutrient and energy needs
micronutrient nutrient found in small quantities within the body but still necessary for physiological functions
mineral essential to physiological processing; some are macronutrients, and some are micronutrients
modified barium swallow study (MBSS) a procedure for viewing the anatomical and swallowing physiology of a bolus of food under video fluoroscopy
parenteral nutrition (PN) nutrition delivered intravenously by a central line
protein macronutrient made up of amino acids
Recommended Dietary Allowances (RDAs) guidelines developed by the U.S. government for consuming the nutrients that make up a healthy diet
Reference Daily Intake (RDI) average daily intake of a population
vitamin essential micronutrient vital to biochemical regulation within the human body

Assessments

Review Questions

1. A nurse is teaching a patient with a nutritional deficit about nutrient-dense foods. What nutrient provides the most energy per gram of nutrient?
   a. carbohydrates
   b. fats
   c. protein
   d. fiber

2. A nurse is caring for an older adult patient who is dehydrated. The nurse understands that the majority of water in the human body is found where?
   a. inside the body cells
   b. in the vascular system
   c. in interstitial fluids
   d. in the urinary tract

3. A nurse is reviewing a patient's medication list and notes the patient takes vitamin D tablets once a day. What does the nurse know is true about vitamin D?
   a. found naturally in many foods
   b. found only in animal products
   c. absorbed through direct sunlight
   d. a trace mineral

4. A nurse in long-term care is reviewing charts for weight loss trends. Which patient is most at risk for developing malnutrition?

Patient	BMI	Weight Change
Patient A	25	Gained 5 pounds in twelve months
Patient B	20	Lost 6 pounds in twelve months
Patient C	18.5	Lost 10 pounds in six months
Patient D	16	Gained 2 pounds in six months

a. Patient A
b. Patient B
c. Patient C
d. Patient D

5. A nurse is working with patients in a public health clinic and is assessing for food insecurity in a local immigrant population. What observation would be most concerning for food insecurity?
a. an immigrant woman applying for SNAP and WIC benefits
b. an immigrant man who is unable to find foods specific to the culture
c. an immigrant couple without personal transportation
d. an immigrant child who does not live near a grocery store

6. A nurse is working with a patient on implementing healthy dietary patterns. The patient decides to develop a healthy weekly menu. What response by the patient indicates understanding of the nutrition guidelines?
a. "RDA values tell me the daily intake for nutrients to guide meal planning."
b. "Proteins are the most important nutrient group."
c. "I should eat the same number of calories at every meal."
d. "I should avoid all simple carbohydrates."

7. A nurse is teaching about nutrition during pregnancy and lactation. What foods would be the healthiest option to meet nutritional goals during this time?
a. whole milk and red meat
b. rice and beans
c. eggs and low-fat dairy
d. fresh fruits and fruit juices

8. A home health nurse is visiting a patient with multiple chronic diseases. The patient is experiencing unintentional weight loss. The nurse considers the role of nutrition in chronic illness. What conditions will not lead to unintentional weight loss in patients with chronic illness?
a. conditions that interfere with nutrient absorption
b. conditions that interfere with ingestion of nutrients
c. conditions that alter the daily allowance of nutrients needed
d. conditions that decrease metabolic rate

9. A nurse is developing a program to promote healthy eating for a local community center. What nutrient should make up the largest daily percentage of intake in a healthy diet?
a. carbohydrates
b. proteins
c. fats
d. simple sugars

10. A patient is learning to read food labels to help with healthy meal planning. How can the patient identify high nutrient values?
   a. These nutrients will be listed first.
   b. The percent daily value per serving will be at least 20 percent.
   c. The per serving percentage will be at least 50 percent.
   d. These nutrients will be identified as "added."

11. A patient with a history of chronic constipation is placed on a high-fiber diet. What food or drink should the nurse recommend?
   a. vegetable juice
   b. eggs
   c. peanut butter
   d. black beans

12. Why does PN require administration through a central venous catheter?
   a. All liquid nutrients are delivered via central line.
   b. PN must be delivered quickly.
   c. PN has a high osmolality and causes vein irritation.
   d. A central line provides direct access to the gastrointestinal tract.

13. A patient has been newly diagnosed with anemia. The goal of treatment is to maintain stable hemoglobin levels. What supplement can help increase hemoglobin levels?
   a. vitamin C
   b. folate
   c. magnesium
   d. calcium

14. A nurse is taking a health history. The patient reports that they have a chronic cough, smoke one pack per week, have food allergies, and have a history of dieting. Which has the most impact on nutritional status?
   a. has a chronic cough
   b. smokes one pack per week
   c. has food allergies
   d. has a history of dieting

15. A nurse is discussing the relationship between metabolic syndrome and chronic disease. What activity would help reverse metabolic syndrome?
   a. increase physical activity
   b. increase lipid levels
   c. maintain a high-protein diet
   d. drink 2 L of water daily

Check Your Understanding Questions

1. Recall nutrients used for regulation in the body. What is the difference between calorie or protein deficiencies and deficiencies in vitamins and minerals?

2. Which three nutrients are considered macronutrients because the large quantities of each are needed daily to meet the body's energy needs?

3. Describe the process known as cellular respiration.

4. What role do culture, religion, and economic status play in food preferences?

5. Identify five nutrients that can be found on a food label.

6. Describe the differences between anorexia nervosa and bulimia.

Reflection Questions

1. When optimal nutrition is not achieved, malnutrition can happen. What are the negative effects of malnutrition on the body?

Critical-Thinking Questions about Case Studies

1. Refer to Unfolding Case Study #3: Part 4.
   The patient tells you they are concerned about their weight gain because they have gained 20 pounds over the last month. What do you think is the most likely cause for the rapid weight gain? And what signs and symptoms would you expect to assess?
2. Refer to Unfolding Case Study #3: Part 5.
   What resources could the nurse provide to the patient?
3. Refer to Unfolding Case Study #3: Part 6.
   What education should the nurse provide to the patient related to sodium intake?

What Should the Nurse Do?

Mr. Curtis is a 47-year-old patient admitted to the hospital with increased weakness, fatigue, and dehydration. His skin appears dry, and tenting occurs when skin turgor is evaluated. He is currently undergoing chemotherapy treatment for multiple myeloma and has experienced weight loss of ten pounds within the last two weeks. He describes that "nothing tastes good," and he feels as if there is "a metal taste in his mouth." When he does eat small meals, he reports that he is often nauseous. The patient's serum protein level is 3.1 g/dL.

1. What assessment cues should the nurse recognize?
2. Based on the assessment information that has been gathered, what are some nursing interventions that can be created for Mr. Curtis?

Mr. Jones is a 67-year-old patient on the medical-surgical floor who recently underwent a bowel resection. He is post-op Day 2 and has been NPO since surgery. He has been receiving intravenous fluids but has been asking about when he can resume eating.

3. What assessments should be performed to determine if the patient's diet can be progressed?
4. What are the first steps during dietary transition from NPO status?

Mrs. Casey is a 78-year-old widow who recently had a stroke and continues to experience mild right-sided weakness. She is currently receiving physical therapy in a long-term care facility and ambulates with the assistance of a walker. Mrs. Casey confides, "I am looking forward to going home, but I will miss the three meals a day here." Her height is 5′2″ and she weighs 84 pounds. Her recent lab work results include the following: hgb 8.8 g/dL; WBC 3,500; magnesium 1.4 mg/dL; albumin 10 g/dL.

5. What is Mrs. Casey's BMI, and what does this number indicate?
6. Analyze Mrs. Casey's recent lab work, and interpret the findings.
7. Describe focused assessments the nurse should perform regarding Mrs. Casey's nutritional status.

Competency-Based Assessments

1. Using the CDC's BMI calculator (https://openstax.org/r/77BMIcalc), calculate and assess your own BMI. Develop a one-week meal plan to promote optimal nutrition based on your personal results.
2. A nurse is caring for an older adult with dysphagia. What should the nurse consider when assisting with planning meals?

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CHAPTER 18

Oxygenation and Perfusion

FIGURE 18.1 The respiratory system and cardiovascular system together form the cardiopulmonary system. Nurses support patients' respiratory needs in many ways, including by providing them with oxygen, as this critical care nurse is doing for a patient with COVID-19. (credit: "Navy Medical Team Suports Louisiana Hospital" by Mass Communication Specialist 2nd Class Michael H. Lehman/Flickr, Public Domain)

CHAPTER OUTLINE

18.1 Respiratory System
18.2 Cardiovascular System
18.3 Factors Affecting Cardiopulmonary Function
18.4 Management of Impaired Cardiopulmonary Functioning

INTRODUCTION Basic life support training uses the first three letters of the alphabet to quickly refer to the most crucial lifesaving actions for a patient who suffers an arrest situation: assessment of the patient's airway, breathing, and circulation. Until a few years ago, these were referred to as they appear alphabetically—A-B-C. The 2010 American Heart Association (AHA) guidelines changed the order to reflect circulation as the first response, followed by airway and breathing, so it is now C-A-B (AHA, 2020).

In either order, the respiratory system is associated with two-thirds of the immediate and emergent lifesaving response recommended for cardiac and/or respiratory arrests, which suggests its importance. The cardiovascular system is also critical because it is the adequacy of the heart's pumping action and vascular circulation that delivers oxygen (O_2) and other nutrients. Without adequate perfusion, all body systems and components are at risk for significant compromise and ultimately cell death. Consequently, the first three letters of the alphabet are certainly appropriate as quick and recognizable identifiers of the most necessary immediate lifesaving measures to take in

hopes of patient survival.

18.1 Respiratory System

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the structures and functions of the respiratory system
- Recognize the physiology of the respiratory system
- Describe the regulation of the respiratory system

The primary purpose of the respiratory (or pulmonary) system is gas exchange, which is necessary to support human life. The **gas exchange** happens where the capillaries and alveoli meet, with a very thin membrane between them—the capillary-alveolar bed (or membrane). The process of breathing—inspiration (inhaling) and expiration (exhaling)— provides O_2 and removes CO_2 waste. The cardiovascular system provides the means of transport for O_2 and other nutrients and the removal of waste products. The blood vessels provide the medium for the exchange of gases by the pulmonary circulation through interaction with respiratory alveoli. The joining of these systems as the **cardiopulmonary system** combines the actions of cardiac **perfusion** (vascular circulation powered by the pumping heart, which delivers O_2 and other nutrients to the body) with **respiratory ventilation** to provide the essential processes of oxygenation and perfusion. Prior to considering the complexity of the combined cardiopulmonary system, each system is explored individually, and these concepts are investigated more deeply later in this section.

This chapter also considers dysfunctions of the cardiovascular and pulmonary systems, diagnostics for recognition and assistance in planning care, and management of patients, particularly nursing actions and skills. The following section explores the structure and function, physiology, and regulation of the respiratory system.

Structures and Functions of the Airway

What is considered the airway consists of structures from the head and face through the pulmonary cavity in the chest (Figure 18.2). The study of the structure (anatomy) of the airway tends to be considered as two components: upper and lower airways. The upper airway extends from the sinuses and nose through the **trachea** to the **carina**, where the airway bifurcates into left and right bronchi and continues into the lungs. This helps to focus on the different locations of the sections of the airway, as well as the normal function of each, and the variation of pathophysiology when things go awry. Disturbed function may arise from a variety of issues, including microbial invasions, exposure to noxious or toxic gases, and injuries. This section explores the structures of the upper and lower airways and their function, physiology of the respiratory system, and respiratory system regulation.

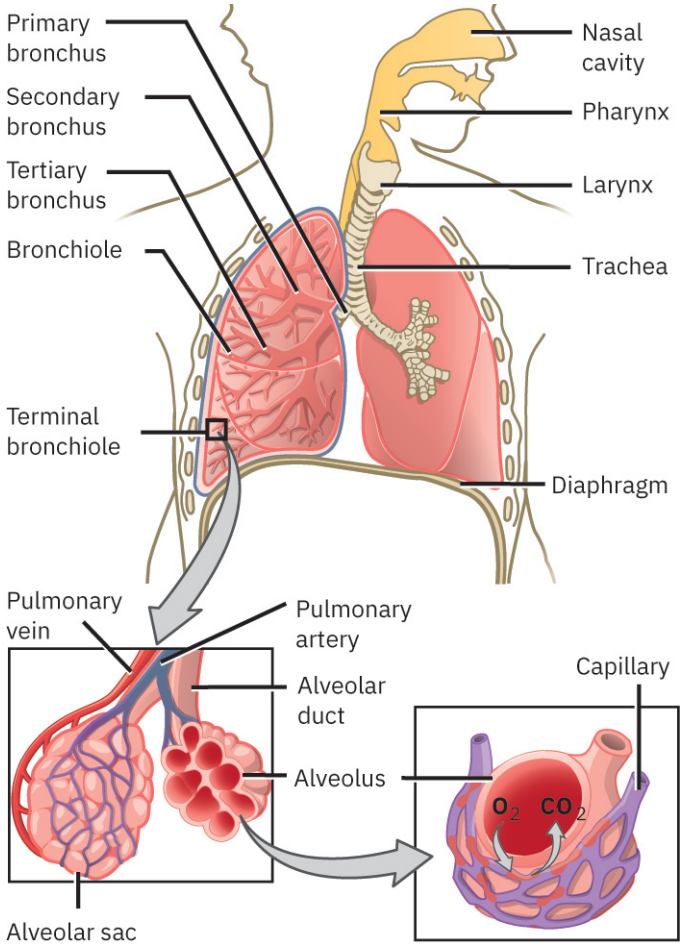


FIGURE 18.2 Air enters the respiratory system through the nasal cavity and pharynx and then passes through the trachea and into the bronchi, which brings air into the lungs. (credit: modification of work from *Biology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Upper Airway

The upper airway includes the trachea as its lowest part and structures above including the sinuses, nose, **pharynx**, **epiglottis**, **glottis**, and **larynx**. Behind the nose is a space that includes the **nasal turbinates** or conchae, which are composed of folded mucosal tissues. The nasal turbinates protect the airway from inhaled particles and increase the surface area in the nasal cavity, helping to warm and humidify inhaled air. The **sinuses** are bilateral cavities named based on the bones where they are located, including frontal (above each eye, maxillary), posterior to the maxillae bilaterally, sphenoid (near the pituitary gland and optic nerves and the sphenoid bone of the eye sockets), and the ethmoid (several small air-filled cells comprising front, middle, and rear groups, each with independent openings to the nasal cavity). The mucus lining the sinuses helps to humidify the air we breathe, and cilia lining the sinuses (hairlike fibers) help to trap and remove excess secretions and foreign objects from the upper airway.

Three regions comprise the pharynx:

- the **nasopharynx**—behind the turbinates at the posterior of the nasal cavity
- the **oropharynx**—located at the posterior of the oral cavity
- the **laryngopharynx**—below the oropharynx, extending to the larynx, familiarly referred to as the voice box

The epiglottis is a cartilaginous structure, which rests its loose end on the glottis, thereby protecting the trachea. When a person swallows, the epiglottis closes the opening from the **esophagus** (part of the gastrointestinal tract, which sits posterior to the trachea), thereby preventing food or fluid from flowing into the trachea. Located within the glottis are false and **true vocal cords**. The **false vocal cords** are also known as vestibular folds and are composed of mucus membrane tissue. True vocal cords have muscular attachments to the thyroid and to laryngeal cartilage; the movement of the inner aspects of the vocal cords provides the mechanism for sound production.

The trachea, commonly referred to as the windpipe, provides the pathway from the upper to lower airways. The esophagus carries fluids and chewed foods from the oral cavity to the stomach. A combination of cartilage and connective tissue gives the trachea its shape and maintains it open for the passage of air. Cilia line the trachea, continuing the process of trapping foreign objects and allowing for their removal, in the same fashion as in the higher structures of the upper airway. Where the trachea bifurcates into the left and right mainstem bronchi is the location of the carina. The carina is the border of the upper and lower airways.

REAL RN STORIES

Endotracheal Suctioning

Nurse: Danisha, RN
Clinical setting: Intensive care unit (ICU)
Years in practice: Less than one year at the time
Facility location: Dallas, Texas

As a student, I took an elective course between junior and senior years of nursing school—it was a course modeled after senior capstone and included 400 clinical hours with a preceptor. My placement was night shift in the ICU. My first night's patient was an older adult Asian female who was intubated and on mechanical ventilation; she was on pressors to maintain her blood pressure adequately. I remember coming in with lofty goals in mind, and when I saw this patient with all the tubes and wires and the monitor and ventilator, I was overwhelmed. One of the first tasks necessitated by the patient's status was to suction her through an inline suction catheter that passed through the endotracheal tube. She was coughing, and my nurse preceptor showed me how to advance the suction catheter through the tube; she demonstrated the suction control, and while withdrawing the catheter, she suctioned the patient of moderate secretions.

As the patient recovered between passes, she asked how I would know if the catheter had advanced to touch the carina. At that point in my nursing education, I had no idea. "She'll cough," she told me, "The carina is sensitive, so when it's touched, the patient will cough, and you've gone too far. Ideally, you want to pay attention to how far that is, so you don't go that far again." Through over ten years in the ICU, I never forgot that recommendation and tried not to stimulate the discomfort of hitting the carina when suctioning.

Lower Airway

The lower airway consists of structures below the carina. The bronchi are the major structures of the lower airway and begin with the bifurcation of the right and left mainstem bronchi, which enter into the right and left lung, respectively. Subsequently, the mainstem bronchi continue paths through the lungs as the primary, secondary, and tertiary bronchi, becoming smaller, and branching further throughout the lungs. Bronchi continue to be lined with cilia and goblet cells for mucus production and have cartilaginous rings like the trachea, to provide support and prevent airway collapse.

From the tertiary bronchi, the branching of the airway becomes even smaller, as they are identified as bronchioles. These continue to their smallest form as terminal bronchioles; at this point, the airway is no longer supported by cartilage, and the muscles comprising the walls can dilate and constrict to control the flow of air. The tiny terminal (or respiratory) bronchioles reach alveolar ducts, which are also a combination of smooth muscle and connective tissues, where alveoli (the minuscule, round sacs of air involved in gas exchange) cluster together. These clusters of alveoli are where the most common type I alveolar cells and the smallest capillaries of the bloodstream exchange gases (primarily O_2 and CO_2) through a very thin alveolar-capillary membrane (Ball et al., 2023). Another alveolar cell type (type II) is responsible for the production of surfactant. A phospholipid substance that prevents the collapse of alveoli by reducing surface tension is called **surfactant**. The third type of alveolar cells, alveolar macrophages, remove foreign substances and waste products from this delicate and essential region.

Lungs

The lungs are responsible for respiration and house the smaller structures involved in the process of ventilation. The right and left lungs are slightly different in structure: the left lung is shaped to include the cardiac notch, which provides space for the heart. The left lung has two lobes: upper and lower; the right lung contains three lobes:

upper, middle, and lower. Normal, healthy lungs are supple and yield in size and shape to the demands of respiration, including **compliance**, the ability to accommodate deep and shallow breaths, and elastic recoil, or the ability to bounce back to normal size and shape after the expansion of inhaling, during exhalation. Lungs are designed to be air-filled. When taxed by disease, fluid accumulation, or exposure to toxic or noxious gases, the lungs can lose effectiveness, and the respiratory processes may become compromised.

Within the lungs are the structures of the lower airway, including the right and left bronchi, primary, secondary, and tertiary, bronchioles, alveoli, and the alveolar-capillary bed, where the cardiopulmonary system interacts, and gases are exchanged. Deoxygenated blood undergoes removal of CO_2, and O_2 is brought into the system. These processes are studied in more detail in the next section, through exploration of the physiology of the respiratory system.

Physiology of the Respiratory System

The exchange of gases, primarily O_2 and CO_2, is the purpose of the respiratory system. The removal of CO_2 during expiration also helps to regulate the body's acid-base balance. Acid-base balance is measured by pH level. The body is sensitive to alterations in pH, and there is a narrow range of normal for pH: 7.35 to 7.45. In circumstances when the body's pH has fallen out of range, the respiratory system is able to adjust quickly in an effort to normalize it (Daniels, 2020). By increasing the rate and depth of respirations, excess CO_2 is released through exhalation, and an acidic pH (less than 7.35) may be improved. An alkalotic pH (over 7.45) may be corrected by shallow, slow breaths, allowing the accumulation of CO_2 to bring pH closer to normal.

Cilia and mucus throughout the respiratory system provide mechanisms for isolating and removing foreign substances, such as inhaled gases and microbiota. Cilia move pathogens and other inhaled particles that become trapped in mucus out of the lungs and into the bronchi, where expectoration is assisted through coughing.

The lungs also play a role in the conversion of angiotensin I to angiotensin II, in conjunction with the renin-angiotensin-aldosterone system (RAAS) (Figure 18.3) (Fountain et al., 2023). Angiotensin II is recognized for its powerful vasoconstriction properties and therefore increases blood pressure. Angiotensin I is produced by a combination of the enzyme renin from the renal system and angiotensinogen. Angiotensin I is not a potent vasoconstrictor, but when combined with angiotensin-converting enzyme (ACE), it is transformed into angiotensin II and increases blood pressure by its properties of vasoconstriction. Capillaries within the lungs are a major location for ACE production.

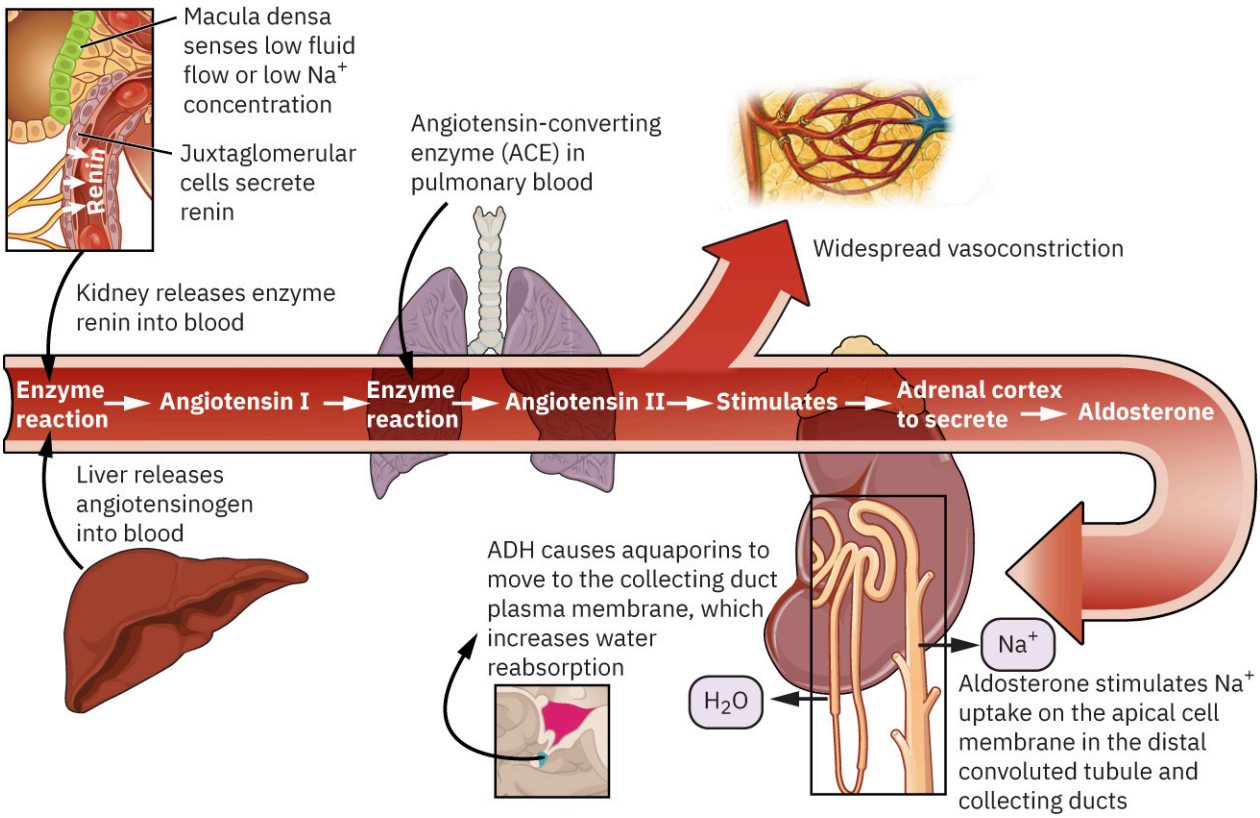


FIGURE 18.3 The renin-angiotensin-aldosterone system regulates fluid output and blood pressure. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Oxygenation involves interactions between the respiratory and cardiovascular systems, including air movement through the lungs, where O_2 and CO_2 are exchanged through the alveoli and capillaries as the respiratory and circulatory systems connect and interact at the alveolar-capillary bed. Physiological processes involved include **ventilation** (the movement of air in and out of the lungs) and perfusion. This combination of respiratory ventilation and cardiovascular perfusion provides O_2 (and other nutrients) to the body's tissues and removes waste products including CO_2 from the tissues.

The part of the respiratory cycle whereby the diaphragm and intercostal muscles contract, which enlarges the space within the thorax, is called **inspiration**. This enlargement lowers the pressure within the alveoli, and air flows into the lungs. During **expiration**, the muscles that expanded the thoracic cavity now relax, and elastic recoil reduces the pressures in the lungs and surrounding thorax. The pressure within the intrapulmonary system is momentarily higher than atmospheric pressure, and air is passively exhaled from the lungs. Lungs that are compliant and retain the properties of elastic recoil are able to increase and decrease in size and shape with each respiratory cycle (Figure 18.4).

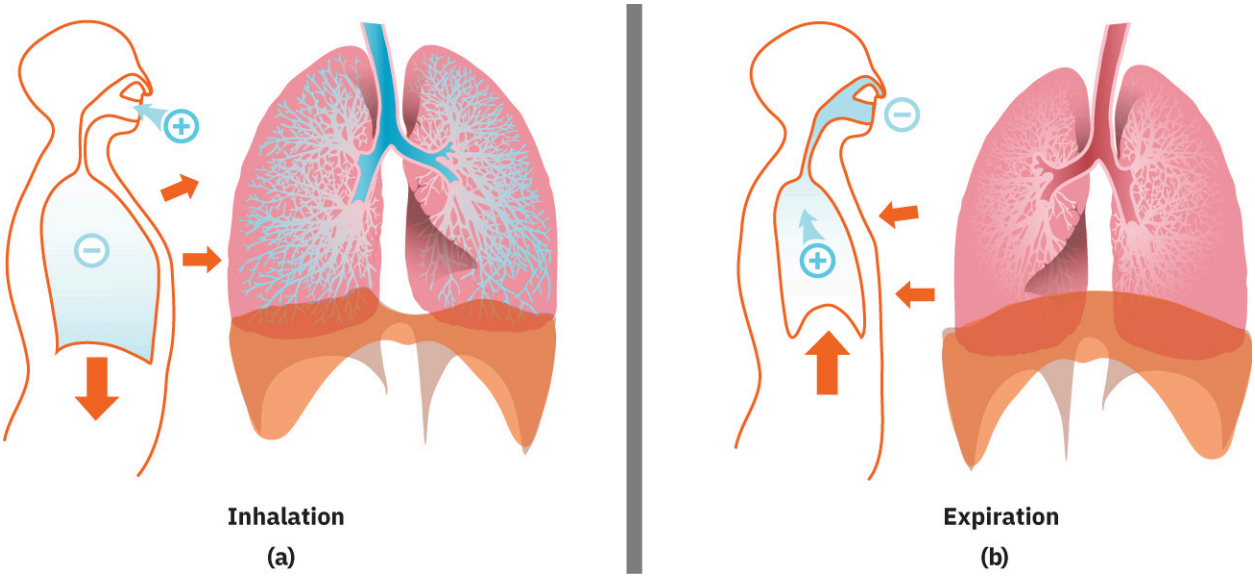


FIGURE 18.4 (a) Inhalation (breathing in) and (b) expiration (breathing out). The orange arrows indicate chest and diaphragm movement as air is inhaled and exhaled. (credit: modification of work from *Biology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Potential problems of the respiratory system include any changes to the normal structure and/or function of any part of the system. This may include injuries, such as rib fracture(s) or burns to any part of the airway. Pathophysiological changes from diseases such as asthma or chronic obstructive pulmonary disease can alter the structure of the airways and the processes and effectiveness involved in gas exchange.

Gas Exchange in Alveoli

Alveoli are found in groups clustered around alveolar ducts, and when inflated, they resemble a cluster of grapes. There are three types of alveolar cells: type I, type II, and alveolar macrophages (Naeem et al., 2022). Type I cells cover approximately 90 percent, or 70 square meters, of surface area within the lungs. These cells are responsible for gas exchange (Figure 18.5). After inspiration, O_2 travels across the capillary-alveolar bed and attaches to hemoglobin, where it is transported throughout the bloodstream and to the body tissues. At the tissues, O_2 is released from the hemoglobin and taken up by the tissues as needed. It is also here that the waste product, CO_2, returns from the body by diffusion (a transport process that involves molecular movement driven by a concentration gradient) into the bloodstream and subsequently the lungs, where it is ultimately removed from the body by exhalation. The respiratory membrane is extremely thin, only about half of a micrometer, which enables gases to easily move to and from the bloodstream and air space within the lungs.

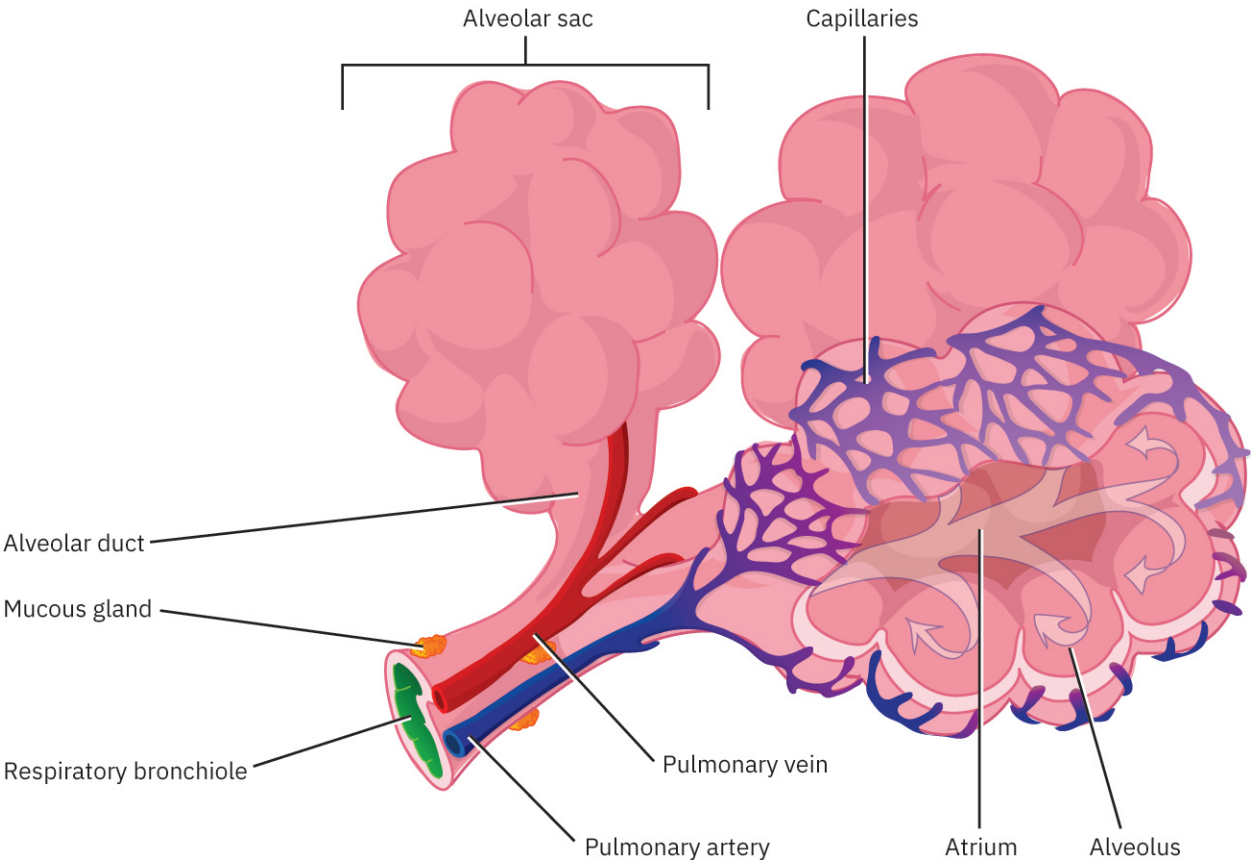


FIGURE 18.5 In the structures at the alveolar-capillary bed are where gas exchange occurs. (credit: modification of work from *Biology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LINK TO LEARNING

Learn more about gas exchange (https://openstax.org/r/77GasExchange) with this resource that includes explanations, images, and a video.

For alveoli to easily reinflate, or to maximize inflation, surfactant is synthesized and released from type II alveolar cells. These cells are located among the type I cells and are made up of proteins and phospholipids. By coating the exterior of the alveoli, the cells reduce the surface tension, which prevents collapse (Naeem et al., 2022). Surfactant is produced by deep breaths, such as sighs, yawns, sobs, and gasps. Deep breaths often inspire coughing, and coughing causes deep breaths, which fosters continued production and release of surfactant and prevention of **atelectasis** (alveolar collapse). For this reason, patients are encouraged to cough and deep breathe when inspiration is limited. Nurses and respiratory therapists (RTs) instruct patients on the use of the incentive spirometer, which involves slow, deep breaths, often subsequent coughing, and tends to improve pulmonary function.

The third type of alveolar cell, the macrophages, like phagocytic cells elsewhere in the body, provide the immune system function of phagocytosis (Naeem et al., 2022). Alveolar macrophages are able to travel within the alveolar areas and isolate, consume, and remove foreign particles that have invaded the alveolar region. These cells are not involved directly in the gas exchange process.

LIFE-STAGE CONTEXT

Incentive Spirometer Patient Education

With advanced age, some people experience hearing deficit or even total hearing loss (deafness). Older adults may

also suffer from one of the cognitive impairments related to dementia. These sensory or cognitive deficits can influence a patient's comprehension of a nurse's teaching because the patient is unable to hear or understand the instructions.

Use of the incentive spirometer can be confusing to patients and requires education by the nurse and/or respiratory therapist to properly describe its use. In addition to telling the patient how to use the device, it is recommended the nurse evaluate the patient's use of the incentive spirometer by demonstration. Often, patients assume that since the mouthpiece is attached to a strawlike hose, they should blow into it instead of the correct action of inhaling deeply through the mouthpiece. The device includes numbers representing volumes, and there is an indicator (piston) that moves with the patient's inhalation (Figure 18.6). Nurses often write a line with a marker to indicate a goal volume for a particular patient.

Patients with hearing impairment or cognitive deficit may require a more active explanation of the use of the incentive spirometer, including a demonstration by the nurse (using an incentive spirometer dedicated to such patient education), which may also include gestures and dramatic movements to illustrate deep intake of breath through the mouthpiece instead of a blowing action. Again, the patient should provide a return demonstration so the nurse is able to assess proper understanding and use of the incentive spirometer. These patients may also respond well to having a goal indicated by a line on the device, and written reminders as to how often and how many inhalations should be done may be helpful, depending on the type and extent of impairment.

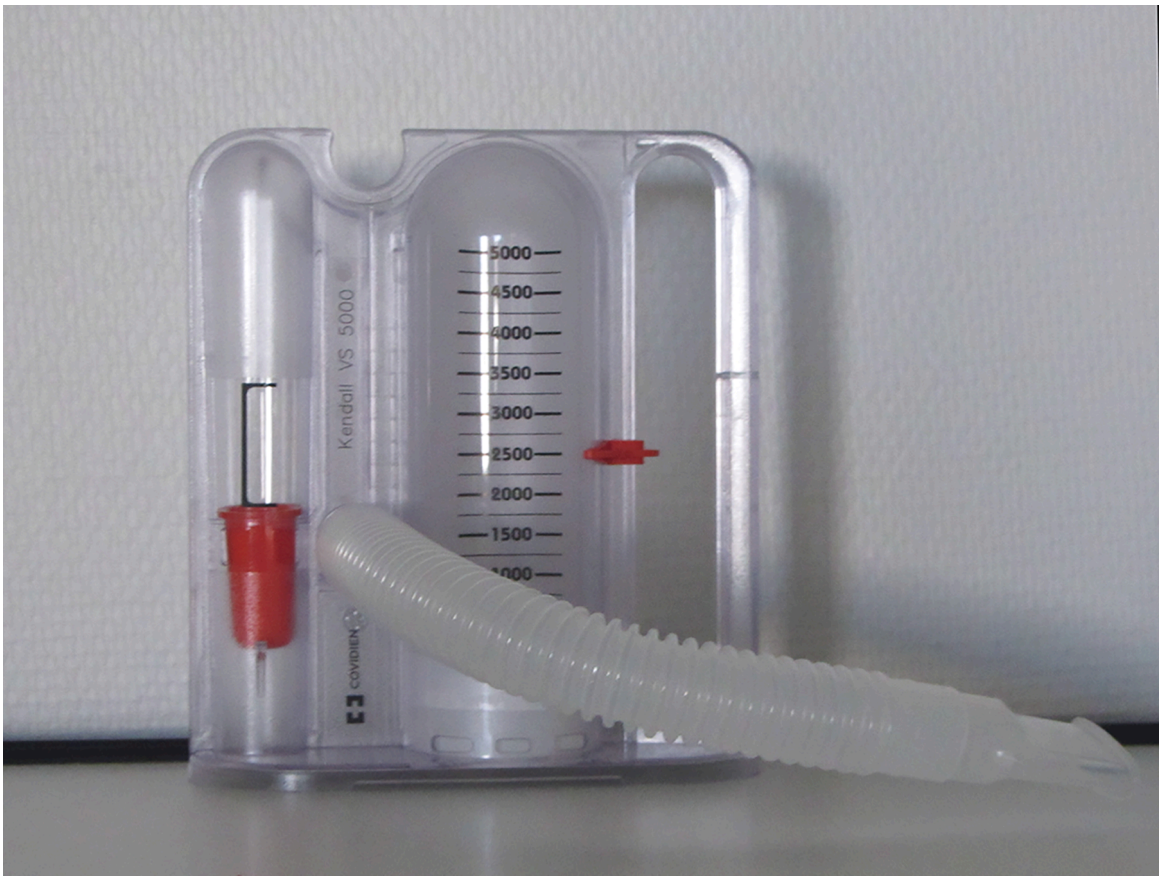


FIGURE 18.6 Explaining the incentive spirometer's components and demonstrating its correct use can help patients understand the device's importance. (credit: modification of work "Kendall Respiflo VS 5000, Atemtrainer, Incentive Spirometer" by Stefan Bellini/ Wikimedia Commons, Public Domain)

Respiration

The term **respiration** is a rather general term, often synonymous with the word *breathing*. It also may be used interchangeably with the term *ventilation*, as it involves inhalation and exhalation. Respiration is associated with the process of gas exchange, the primary purpose of the respiratory system.

Respiration is a basic function, generated by the neurological system, with control centers within the medulla oblongata and pons. Regulation by these systems, including actions stimulating the length and depth of each breath, is controlled by opposing actions of the apneustic and pneumotaxic centers, in efforts to maintain homeostasis, or stability, throughout the body.

Respiration is a critical function and is included as one of the vital signs, which most commonly include respiratory rate, heart rate, temperature, and blood pressure. In addition to the respiratory rate, nursing assessment of the respiratory system also includes auscultation of breath sounds and observation of depth and regularity of breathing, symmetry, whether the patient relies on the use of accessory muscles to breathe, their desired position, and how they breathe (e.g., pursed lips, gasping, apneic pauses), as well as apparent anxiety. A noninvasive device called a **pulse oximeter** measures saturation of hemoglobin with O_2 and can be a valuable respiratory assessment tool. Arterial blood gas (ABG) testing offers important data in some circumstances of respiratory compromise and potential failure, but ABGs are invasive and typically considered painful. Additional diagnostics may include chest radiographs (x-rays), computed tomography or magnetic resonance imaging, ventilation-perfusion (V/Q) scan, and a variety of pulmonary function tests, depending on the diagnosis being explored.

Diffusion

Diffusion is a transport process that involves molecular movement driven by a concentration gradient. Molecules move from areas of high concentration to those with low concentration. In the case of respiratory gas exchange, diffusion is the primary process for the transport of gas molecules, moving the gas that is in high concentration to a low concentration area. Concentration gradients and the diffusion process are responsible for the exchange of gas between blood, with a high concentration of CO_2 and low O_2 concentration from the body, and the air in the lungs, which is high in O_2 concentration and has low CO_2 levels. The diffusion process is often very dynamic, as is the case in the respiratory system, as the molecules are not static. The concentration of gases changes with each breath and as tissues take up O_2 and release wastes.

Perfusion

Perfusion, as previously defined, is associated with the circulatory system and is evidenced by the cardiovascular system's delivery of O_2 and nutrients to body tissues. Adequate perfusion indicates there is enough pumping action of the heart, which is referred to as **contractility**, and enough volume in the body's vascular system, as shown by a normal blood pressure. Under conditions of adequate perfusion, patient assessment includes vital signs within normal ranges, normal or baseline mentation, pulses typified as 2+ (normal), no dependent edema noted, breath sounds that are clear without adventitious sounds, and skin that is warm, dry, and of normal color for race.

Inadequate perfusion tends to involve a variety of signs and symptoms. Examples of poor perfusion include deterioration of vital signs, which may include **tachycardia** (heart rate over 100 beats per minute), hypotension (low blood pressure, e.g., under 90 systolic), abnormal body temperature, **tachypnea** (respiratory rate over 20 breaths per minute), mental status or level of consciousness changes that may range from slight confusion to lethargy to unconsciousness, peripheral edema, potentially adventitious breath sounds like crackles, and skin that feels cool, clammy, and is notably changed in appearance from normal to demonstrating pallor.

Respiratory changes due to lack of perfusion are particularly important, as the respiratory system is often the first to display signs and symptoms indicative of this negative status change. The signs emanating from the respiratory system may be obvious, such as tachypnea or crackles, or may be reflected in a neurological change, such as a change in mental status.

Regulation of the Respiratory System

The respiratory system is controlled by the neurological system. As a basic function of life, respiration is an involuntary effort. Control of several involuntary respiratory and cardiovascular functions, and some movement of the muscular system, originates within the brainstem and cerebellum.

The medulla oblongata, the primary respiratory center in the brainstem, is responsible for signaling to respiratory muscles that allow the process of ventilation. The two sets of respiratory muscles are the ventral and the dorsal respiratory groups, and they cause muscle movement for expiration and inspiration, respectively. Some reflex responses like sneezing, vomiting, and coughing are also under the control of the medulla.

The respiratory rate is controlled by the pons. There are two centers within the pons that are involved in this

process. First is the apneustic center, which is involved in signals for length and depth of breaths, or **tidal volume**. The intensity of respirations is limited by stretch receptors of the muscles involved in breathing and by further signaling from the pneumotaxic center. Inhibitory signals from the pneumotaxic center also provide fine-tuning of respiratory rate control by limiting the action of the phrenic nerve. The actions of the pneumotaxic center lead to diminished tidal volume.

LINK TO LEARNING

Watch the video "Neural Control of Breathing: Respiratory System" (https://openstax.org/r/77NeurConBreath) and make note of the importance of C-5 as the narrator says, "C-5 Keeps You Alive." Also, notice the impact of thoracic nerves on breathing.

Dyspnea

The medical term for the subjective feeling of shortness of breath or difficulty breathing is dyspnea. Patients can be asked to rate their dyspnea on a scale of zero to ten, similar to using a pain rating scale. The feeling of dyspnea can be very disabling for patients. Nurses can objectively assess the response to the experience by noting a climbing respiratory rate, shallow breaths, the use of accessory muscles, and whether the patient is able to speak only one word between breaths. Certain pathological changes to normal physiology, like asthma, heart failure (HF), chronic obstructive pulmonary disease (COPD), **hypercapnia** (elevated CO_2), and anxiety, may contribute to dyspneic episodes. Interestingly, anxiety can both cause and result from dyspnea, as struggling to breathe is one of the most helpless, frightening experiences most people can have.

Episodes of dyspnea may or may not require intervention from the healthcare team. Sometimes, the symptoms are mild and transitory, resolving as quickly as they began. However, if the patient's respiratory status is compromised, prompt action may be necessary. Observations and assessments of respiratory deterioration may include a falling O_2 saturation as seen on pulse oximeter, exhaustion from sustained tachypnea and use of accessory muscles, intolerance of lying flat, and decreased breath sounds.

CLINICAL JUDGMENT MEASUREMENT MODEL

Recognize Cues: Patient with Dyspnea

Mr. Wu is a 73-year-old Asian immigrant who moved to California when he was 27 years old. Mr. Wu has been smoking two packs of cigarettes a day since he was 15 years old and was diagnosed with emphysema ten years ago. He presents to the emergency department stating he cannot breathe. Mr. Wu is sitting upright on the gurney and leaning forward onto the bedside table.

The nurse asks about his health history, and Mr. Wu is only able to say one word before he has to pause to try to catch his breath. The nurse auscultates Mr. Wu's breath sounds and can barely hear inspiratory and expiratory sounds from either front or back.

Mr. Wu's vital signs are as follows:

- HR 118 beats per minute
- BP 162/94
- RR 26 breaths per minute
- T 99.3°F
- SaO_2 75 percent

The nurse considers this patient's subjective and objective presentation and determines the following: Important information includes medical history and vital signs (HR, BP, RR, SaO_2). Priority information includes SaO_2 and severely diminished breath sounds. Ventilation and oxygenation are the nurse's immediate concern.

Hypoxia

A reduced level of tissue oxygenation is the definition of **hypoxia**. Hypoxia has many causes, ranging from

respiratory and cardiac conditions to anemia. A specific type of hypoxia is **hypoxemia**, defined as decreased partial pressure of oxygen in the blood (PaO_2) indicated in an ABG result.

Early signs of hypoxia are anxiety, confusion, and restlessness. As hypoxia worsens, the patient's level of consciousness and vital signs will worsen with an increased respiratory rate and heart rate and decreased pulse oximetry readings. Late signs of hypoxia include bluish discoloration of the skin and mucous membranes called **cyanosis**.

Hyperventilation

Rapid, deep breathing is referred to as **hyperventilation**. A faster respiratory rate and depth cause low levels of CO_2 in the blood. Hyperventilation can occur due to anxiety, panic attacks, pain, fear, head injuries, or mechanical ventilation. Acute asthma exacerbations, pulmonary embolisms, or other respiratory disorders can initially cause respiratory alkalosis as the lungs breathe faster in an attempt to increase oxygenation, which decreases the $PaCO_2$. After a while, however, these hypoxic disorders cause respiratory acidosis as respiratory muscles tire, breathing slows, and CO_2 builds up in the blood (Table 18.1).

Physiological Challenge	Respiratory Pattern	Subsequent Acid-Base Imbalance	Resultant Compensatory Change	Ideal Result
Anxiety, pain, fear, asthma exacerbation, pulmonary embolus	Hyperventilation	Respiratory alkalosis (pH >7.45; $PaCO_2$ <35 mm Hg)	Hypoventilation in response to alkalosis	Normal pH (acid-base balance) with return to normal respiratory rate and depth
Decreased level of consciousness, obesity, weak respiratory muscles	Hypoventilation	Respiratory acidosis (pH < 7.35; $PaCO_2$ >45 mm Hg)	Hyperventilation in response to acidosis	Normal pH with return to normal respiratory rate and depth

TABLE 18.1 Hyperventilation and Hypoventilation

18.2 Cardiovascular System

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Analyze the structures and functions of the cardiovascular system
- Understand the physiology of the cardiovascular system
- Recall regulation mechanisms of the cardiovascular system

In this section, the cardiovascular system is at the center of discussion. Without the cardiovascular system, gas exchange would not be useful, as perfusion is necessary for O_2 and other nutrients to be distributed throughout the body and reach the tissues.

The contribution of this critical body system to the essential process of oxygenation is its pump and tank, which circulate and deliver vital elements to cells and tissues. This section explores the structure, function, and regulation of the cardiovascular system and its indispensable role in oxygenation.

Structures and Functions of the Cardiovascular System

The heart is the central feature of the cardiovascular system; it is the pump that provides power. Considering the heart as the pump, the volume of circulating fluid is stored in the body's fuel tank and dispersed throughout the body by the blood vessels, or the vascular system. There has to be an adequate amount of fuel within the tank to be pumped around the body and perfuse the cells, tissues, and organs.

Heart

The human heart is located within the thoracic cavity, medially between the lungs in the space known as the **mediastinum**. The great veins, the superior and inferior venae cavae, and the great arteries, the aorta and

pulmonary trunk, are attached to the superior surface of the heart, called the base. The base of the heart is located at the level of the third costal cartilage. The inferior tip of the heart, the apex, lies just to the left of the sternum between the junction of the fourth and fifth ribs. It is important to remember the position of the heart when placing a stethoscope on the chest of a patient and listening for heart sounds.

The heart consists of four chambers: two atria and two ventricles. The right atrium receives deoxygenated blood from systemic circulation, and the left atrium receives oxygenated blood from the lungs. The atria contract to push blood into the lower chambers, the right ventricle, and the left ventricle. The right ventricle contracts to push blood into the lungs, and the left ventricle is the primary pump that propels blood to the rest of the body.

The heart tends to be considered as the muscle it is, but its structure actually includes three layers of slightly different cellular makeup. The outer layer is composed of fat and connective tissue and is an extension of the serous pericardium, one of three layers of protective pericardial tissue that surrounds the heart. Endothelial cells make up the heart's inner layer and envelop the valves; this tissue is the same as that of the inner layer of the nearby larger blood vessels. It is the midlayer of the heart that consists of muscle cells specific to the heart. The coronary arteries are the source of perfusion specifically to the heart muscle cells, or **cardiomyocytes**.

Cardiac cells are unique in a few ways. First, they are able to initiate spontaneous action potential, also called **automaticity**. Another distinctive property is the heart's own circulation: coronary arteries perfuse the cardiac muscle itself, and this blood flow is primarily supplied during diastole. Cardiac perfusion is enhanced by vasodilation of coronary arteries in response to catecholamines, hormones that function as neurotransmitters.

Blood Vessels

After blood is pumped out of the ventricles, it is carried through the body via blood vessels. An **artery** is a blood vessel that carries blood away from the heart, where it branches into ever-smaller vessels and eventually into tiny capillaries where nutrients and wastes are exchanged at the cellular level (Figure 18.7). Capillaries combine with other small blood vessels that carry blood to a **vein**, a larger blood vessel that returns blood to the heart. Compared to arteries, veins are thin-walled, low-pressure vessels. Larger veins are also equipped with a **valve** that promote the unidirectional flow of blood toward the heart and prevent backflow caused by the inherent low blood pressure in veins as well as the pull of gravity (Figure 18.8).

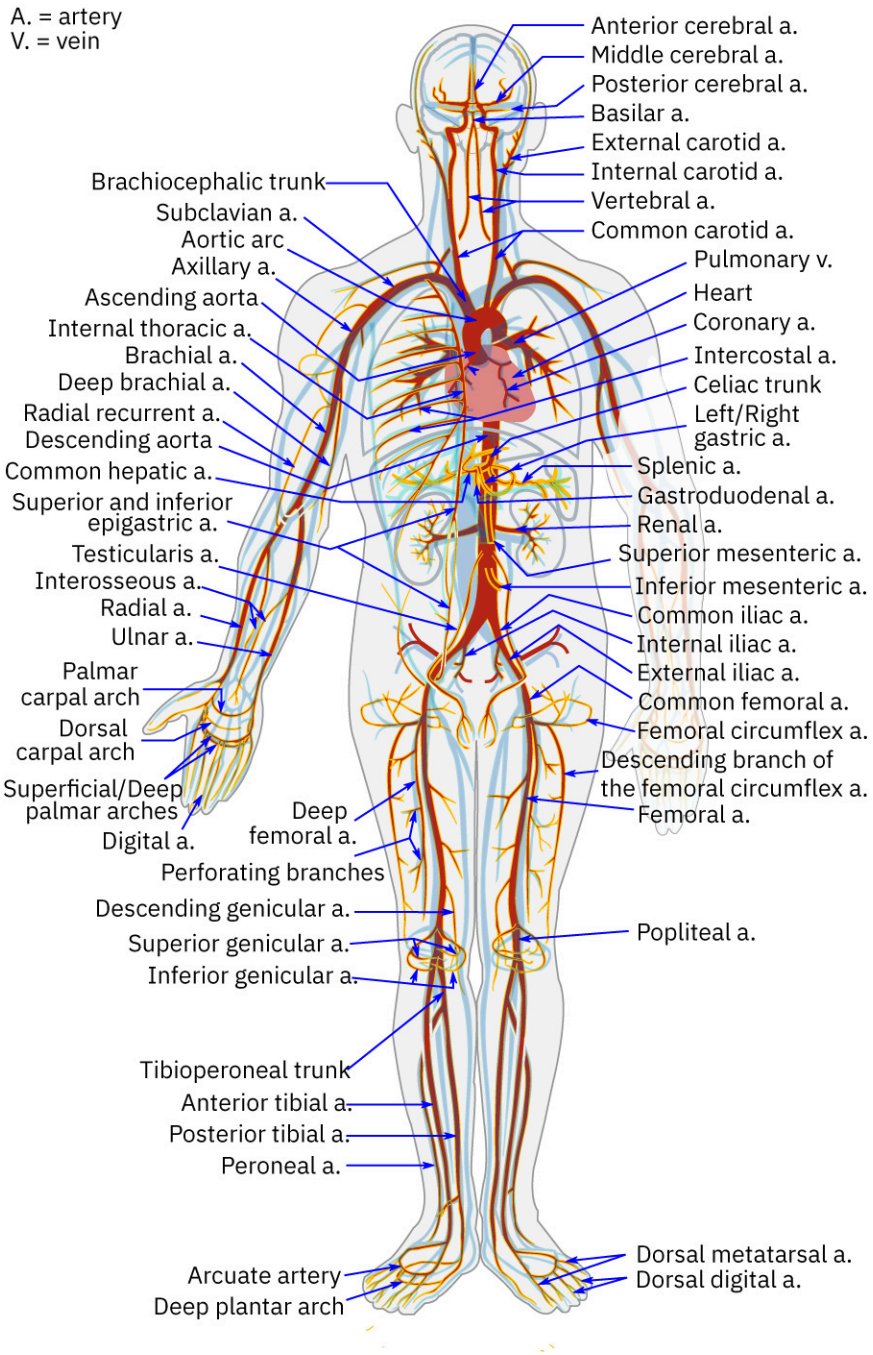


FIGURE 18.7 The arteries in the circulatory system carry oxygenated blood from the heart throughout the body. (credit: "Arterial System" by "LadyofHats"/Mariana Ruiz Villarreal/Wikimedia Commons, Public Domain)

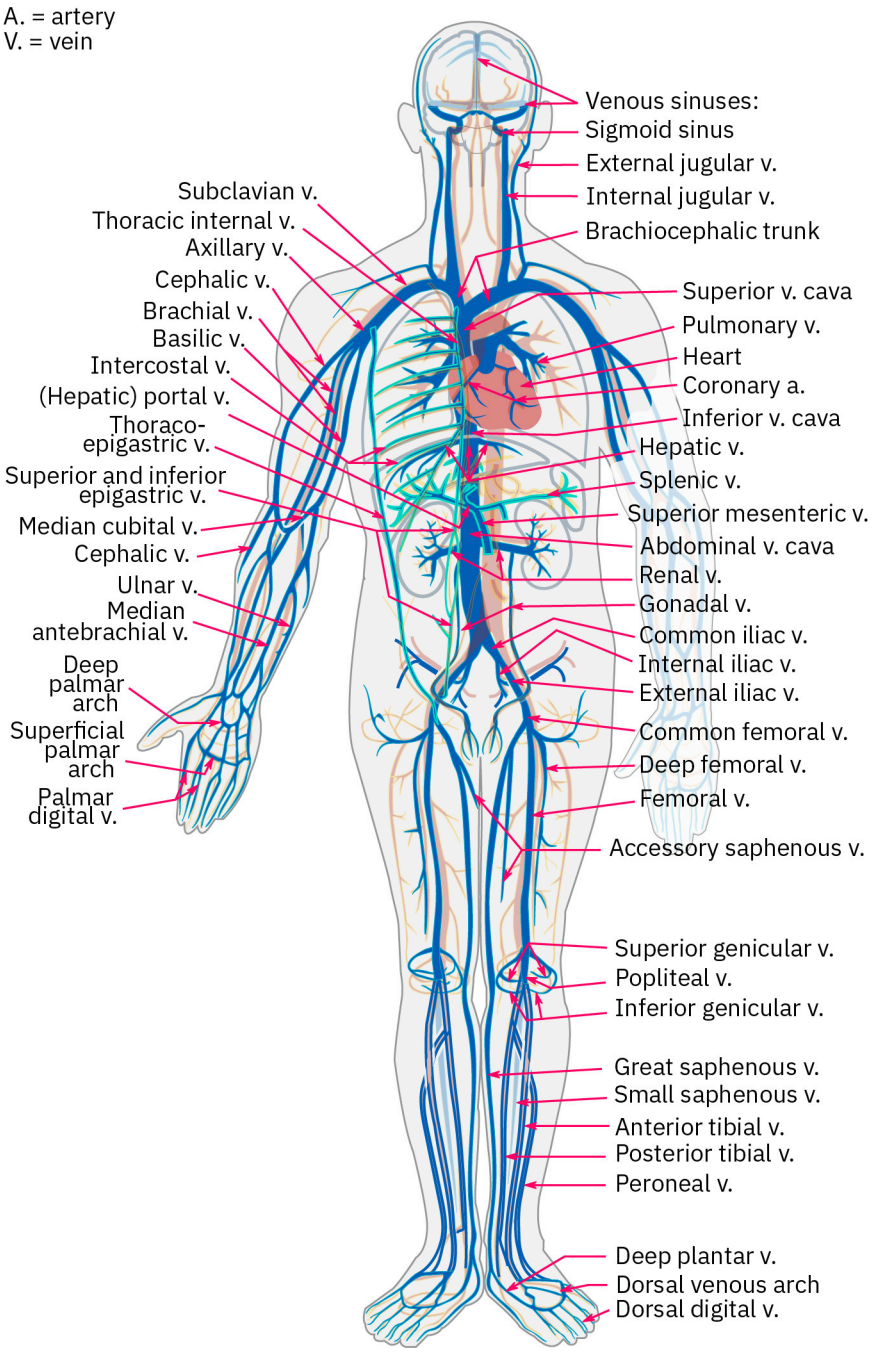


FIGURE 18.8 The veins in the body carry blood to the heart to be oxygenated. (credit: "Venous System" by "LadyofHats"/Mariana Ruiz Villarreal/Wikimedia Commons, Public Domain)

In addition to their primary function of returning blood to the heart, veins may be considered blood reservoirs because systemic veins contain approximately 64 percent of the blood volume at any given time. Approximately 21 percent of the venous blood is located in venous networks within the liver, bone marrow, and integument. This volume of blood is referred to as **venous reserve**. Through venoconstriction, this reserve volume of blood can get back to the heart more quickly for redistribution to other parts of the circulation.

The amount of fluid within the blood vessels, or **intravascular volume**, contributes to blood pressure as measured by pressure within the arteries. Other organs may contribute waste products from metabolic functions into the bloodstream to be transported for further metabolism, and ultimately for some waste excretion from the body. An example is water entering the body through oral intake, absorption through the gastrointestinal tract, delivery to cells in need of fluid, and excess being delivered to the renal system for processing and urinary excretion.

Physiology of the Cardiovascular System

From the first heartbeat to the last, the cardiovascular system is responsible for a constant blood supply to all body systems, including its own. Blood flow provides nutrients of all types to body tissues, and its allotment to specific areas changes as physiological demands change. Activity and rest alter the needs for O_2, and nutrients such as carbohydrates, proteins, and fats, as well as dispersing hormones and other chemicals at the correct times to meet the body's requirements. All systems require constant blood flow, though most have periods of high versus low demand. Even the cardiopulmonary requirements are reduced during low activity but increase during stress, exercise, and any other stimulation of the sympathetic nervous system. The brain is an exception, as its need for circulation is continual and essential to the normal function of many bodily processes.

Blood pressure (BP) and heart rate (HR) vary in response to the demands of activity and rest, and they also vary as needed as the body reacts to fluid changes, autonomic nervous system input, and other systemic influences. Another concept is that of cardiac output (CO), which is the amount of blood pumped by the left ventricle in one minute. Cardiac output is considered one of the advanced hemodynamics (beyond basic vital signs) that can be monitored in certain critical care settings with specialized equipment. Refer to Table 18.2 for more details about the information provided, the formulas involved (Bonsall, 2016; Bruss & Raja, 2022), and examples.

Terms	**Cardiac Output** (CO): amount of blood pumped by the heart in one minute Normal range 4 to 8 liters/minute (L/min)
	Cardiac Index (CI): CO with consideration for body surface area (BSA) Normal range 2.5 to 4 L/min/m^2
	End-systolic volume (ESV): amount of blood remaining in the heart at the end of systole*
	End-diastolic volume (EDV): amount of blood remaining in the heart at the end of diastole*
	Heart Rate (HR): number of heartbeats per minute Normal range 60 to 100 bpm
	Stroke Volume (SV): left ventricular volume pumped with each beat of the heart Normal is approximately 1 mL/kg of body weight; obtained by echocardiogram, Doppler ultrasound*
Calculations	CO = HR × SV CI = CO/BSA SV = EDV – ESV **Note:** These are not typically calculated by bedside ICU nurses but are monitored by them for trends and hemodynamic changes.
Examples	• A patient with a slow HR (bradycardia). This HR leads to a lower CO, but the SV may compensate by ejecting more volume with each beat. This allows for the continuation of normal CO, at least temporarily. • A patient with a fast HR (tachycardia). This increase in HR can compensate, at least temporarily. However, if the HR becomes too fast, SV suffers because there is not enough time for ample ventricular filling.

*ESV, EDV, and SV are obtained by specialized testing. Information is entered into the CO monitor, and it obtains actual and/or estimated information that is converted into numbers displayed for continuous monitoring.

TABLE 18.2 Advanced Hemodynamics

Circulation

There are two distinct but linked circuits in human circulation called the pulmonary and systemic circuits (Figure

18.9). The pulmonary circuit transports blood to and from the lungs, where it picks up oxygen and delivers carbon dioxide for exhalation. The systemic circuit transports oxygenated blood to virtually all of the tissues of the body and returns deoxygenated blood and carbon dioxide to the heart to be sent back to the pulmonary circulation.

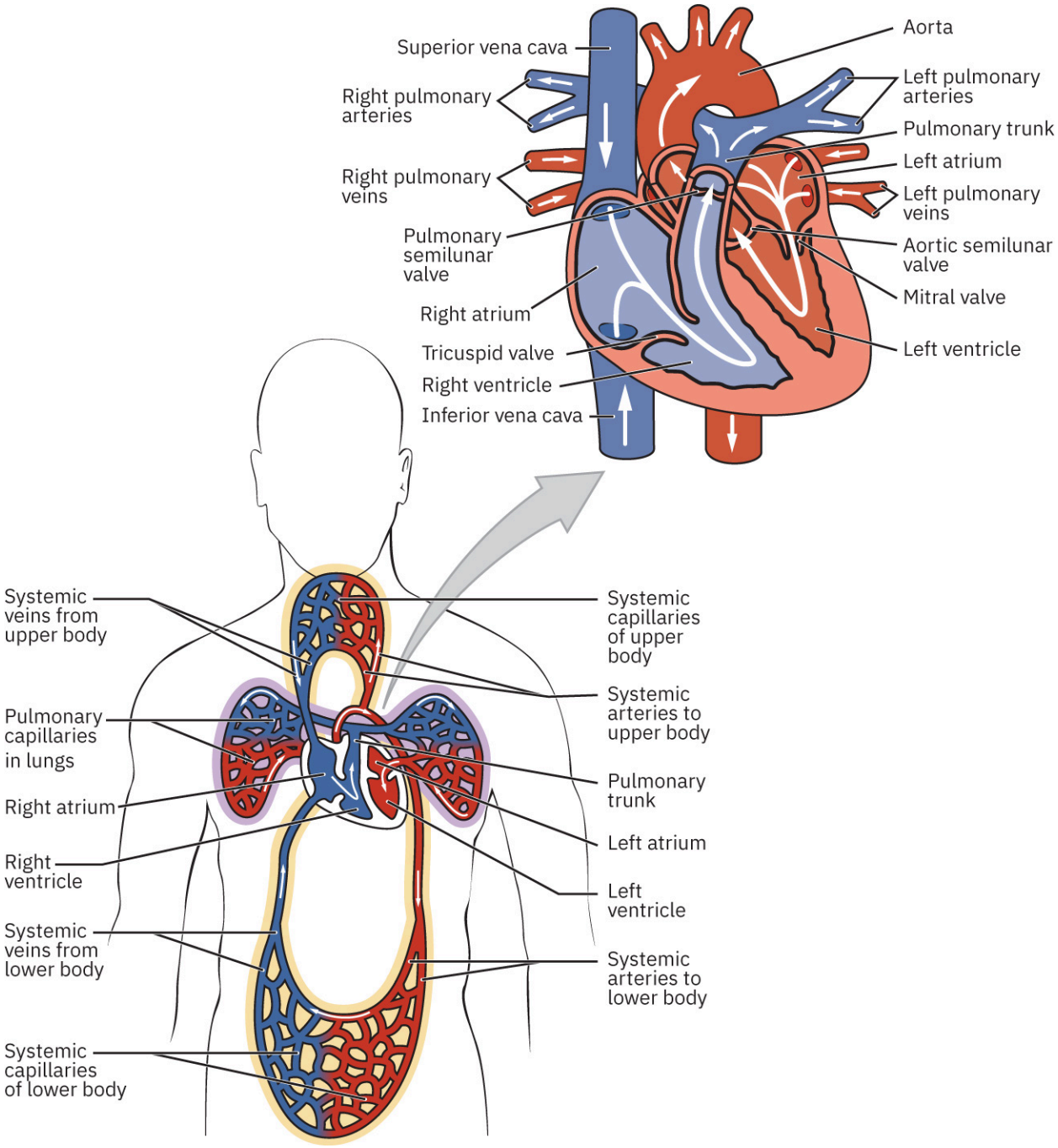


FIGURE 18.9 Blood flows through the cardiopulmonary circuit and the heart. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

There are potential physiological interruptions that lead to a body not being in a state of homeostasis. An example is **arteriosclerosis**, or stiffening of the arterial walls, and a subcategory, **atherosclerosis**, or buildup of plaque deposits within the artery walls. Arteriosclerosis lessens the elastic properties of blood vessels and, therefore, the ability for vasodilation, which increases the intravascular pressure. Atherosclerosis narrows the internal space of blood vessels, which also increases the pressure within the intravascular space. These two pathophysiological properties often occur together, and either can cause hypertension when renal arteries are impacted. While hypertension is a possible result, uncontrolled hypertension is also a risk factor for the development of arteriosclerosis (AHA, 2023;

Poznyak et al., 2022). Other risk factors include dyslipidemia, diabetes mellitus (DM), and cigarette smoking. Hypertension contributes to the development of arteriosclerosis by thickening the walls of blood vessels, plaque development, and the potential for rupture of the blood vessel walls. It is not uncommon for patients with these diagnoses to also be hypervolemic, from either cardiac or renal (or a combination) dysfunction. In these cases, multiple pathologies are contributing to excessive vascular volume and pressure. Temporary increases in fluid and BP can be helpful compensatory mechanisms for the improvement of perfusion; however, with these diagnoses, there is little relief from the elevated pressures, little rest for the body system, and ultimately, a reduction in perfusion.

Another example of a lack of stable perfusion is hypovolemia or a lack of fluid in the vascular space. This can be from different issues, like blood loss from surgery or traumatic injury, or fluid loss from exertion or hot weather. The loss of volume means less fluid volume in the circulatory system, which is typified by a low BP, manifested by signs and symptoms of low perfusion, such as mental status changes ranging from slight confusion to, potentially, seizure, cool and clammy skin, low urine output, climbing creatinine, and other laboratory results illustrating a concentrated sample.

CULTURAL CONTEXT

Buerger Disease

Buerger disease (BD) affects small blood vessels and causes a lack of perfusion often leading to gangrene and subsequent amputation. The major risk factor for BD is cigarette smoking, and it occurs more frequently in men than women (Baran et al., 2019; Bucci et al., 2013; Kurata et al., 2003). In spite of the risks associated with smoking, many patients who have suspected or confirmed BD are addicted to nicotine and/or the habitual behaviors associated with smoking and find it impossible to quit.

In the United States, a patient example from the early 2000s illustrates the grip smoking often has on people: the patient was a female about 55 years old, who had spent many years as a nurse. She was also a cigarette smoker of at least a pack per day for forty years. At the time of the nursing encounter, the patient was hospitalized in anticipation of her fourth limb amputation secondary to BD. Her three other limbs had been amputated above the joints (knees and elbow), and the remaining arm was scheduled for amputation. The patient had continued to smoke up to just prior to admission.

Some recent studies about smoking and smoking cessation have brought some insight into the cultural component of smoking and the difficulty of "kicking the habit." Smoking has long been associated with masculinity (Khanal et al., 2023). It can be difficult to overcome long-standing traditions, in spite of the potential contribution to disease processes like BD.

Another study focused on socioeconomic factors and noticed that higher rates of smokers were found within lower socioeconomic positions (Manns et al., 2023). One of the reasons given for difficulty in cessation of smoking is a lack of support for, and more barriers to, quitting. Also noted, the sociocultural circle within the lower socioeconomic positions tends to include more smokers, and therefore, a culture of continued cigarette smoking.

In a study exploring the reduction of the smoking habit, there is hope for the role of family support offering a positive impact on cessation (Cho et al., 2023). Smokers eating alone were found to smoke more than those who ate meals with their families. Cultural input can be influential to behaviors, whether in supporting smoking or its cessation. The value of a strong social circle, offering group interest and support to quitting smoking brings hope to those attempting to quit a highly addictive habit like smoking.

Stroke Volume

The amount of blood expelled from the left ventricle during a single systolic contraction is known as **stroke volume (SV)**. Three primary factors that affect SV are **preload**, or the stretch on the ventricles prior to contraction; contractility, or the force or strength of the contraction itself; and **afterload**, the force the ventricles must generate to pump blood against the resistance in the vessels. The calculation for SV is EDV – ESV.

The **ejection fraction (EF)** is the percentage of blood within the ventricle that is expelled during a single systolic

contraction. A low EF means that the heart is not creating an efficient contraction, and this is a sign of HF. HF can occur with intact EF, or it can be reduced. Normal EF is approximately 50 to 70 percent; it is therefore considered preserved if it is over 50 percent (Bruss & Raja, 2022). Reduced EF is indicated when there are clinical manifestations of HF and the EF is at or under 40 percent. The formula for EF is SV/EDV. Cardiologists use information about EF to explore cardiac-related diagnoses like hypertrophy and HF, as well as to confirm adequate perfusion and function.

LINK TO LEARNING

Learn more about EF and its relationship to HF (https://openstax.org/r/77EFHFRelation) in this video.

Regulation of the Cardiovascular System

Cardiovascular regulation is an autonomic body function that is controlled from within the brainstem, specifically the cardiovascular center of the medulla oblongata. Recall that the autonomic nervous system (ANS) has two systems: the sympathetic nervous system (SNS), nicknamed the "fight or flight," and the parasympathetic system (PSNS), with the nickname "rest and digest." The SNS, when stimulated, is involved in the release of powerful neurotransmitters like epinephrine and norepinephrine, to initiate physiological responses like bronchodilation, pupillary dilation, glucose release, increased HR and BP, which may assist the person to escape a life-threatening circumstance.

As the term "fight or flight" indicates, this may allow for a burst of energy and strength to battle or flee from an aggressor. In the case of illness, such physical responses may provide at least temporary improvement of vital signs to preserve adequate perfusion until medical assistance can be provided. The PSNS is associated with responses opposite those of the SNS, including slow HR, lower BP, constricted pupils, and bronchoconstriction. With proper function, the two systems work in concert to maintain homeostasis.

There are three functional centers within the cardiovascular center, responsible for different responses and actions. First, the cardioaccelerator center is involved with the stimulation of the SNS and the cardiac accelerator nerve. The result, as the name and association with the SNS indicate, are signs and symptoms of SNS responses, some of which were previously listed. The second center is the cardioinhibitory center, which works with the PSNS and the vagus nerve. When stimulated, it results in the PSNS reactions including those listed earlier. Finally, the vasomotor center is involved with the contraction of smooth muscles and vascular tone, which is necessary for the constriction of blood vessels and, therefore, regulation of BP.

The nervous system plays a critical role in the regulation of vascular homeostasis based on baroreceptors and chemoreceptors. Baroreceptors are specialized stretch receptors located in the aorta and carotid arteries that respond to the degree of stretch caused by the presence of blood and then send impulses to the cardiovascular center to regulate BP. In addition to the baroreceptors, chemoreceptors monitor levels of oxygen, carbon dioxide, and pH. When the cardiovascular center in the brain receives this input, it triggers a reflex that maintains homeostasis.

REAL RN STORIES

Balancing Cardiopulmonary Nursing Care

Nurse: Amanda, RN
Clinical setting: Cardiovascular ICU
Years in practice: Less than one year at the time of the event
Facility location: Delta, Colorado

I started my career as a new graduate nurse in a Cardiovascular ICU working nights. On one particular shift, I was assigned to take a report from the emergency department (ED) on a Black male patient who had presented about an hour earlier with chest pain, dyspnea, and hypertension. A twelve-lead electrocardiogram (ECG) in the ED did not show any signs of ST elevation, and oral nitroglycerin, morphine, and 2 L of O_2 via nasal cannulas subsided his

symptoms. The emergency room had placed him on a nitroglycerin drip and was sending him to my unit to be on observation overnight. This was a standard chest pain observation patient, and the cardiologist had a standing order set that allowed me to titrate the nitroglycerin to chest pain and to keep the systolic BP above 90 mm Hg.

I distinctly remember this patient, as he could not move without his chest pain increasing and becoming short of breath. Just admitting him to his room I had to increase the nitroglycerin drip to keep his pain under control and help his oxygenation. Soon after he settled, however, a fifteen-minute BP check showed his pressure had plummeted to 87/45, just with a minor adjustment of the drip. I decreased the drops (gtt). In about fifteen to twenty minutes after this decrease, he began to rate his chest pain at a four out of ten and complained of not being able to catch his breath. However, his pressure only increased a bit, hovering around 90 systolic, so I knew increasing the drip would only cause that pressure to plummet. I increased his O_2 to 4 L, called the physician, and received PRN orders for morphine every four hours as needed. This did help his breathing and pain. What ensued for the next five hours of my shift was a delicate balance of titration of nitroglycerin, morphine (when able), O_2, keeping the patient still, and a lesson for me in the significant relationship of the vascular system and respiratory system. When his chest pain increased, I knew his BP would be stable, however, his breathing would not be. The amount of nitroglycerin needed to keep his pain gone and his breathing stable was not stable for his BP, and it had to be supplemented with morphine and, at times, increasing his O_2. After about five hours of this and a few phone calls from me, the cardiologist took him to the Cath lab around 2 a.m. A stent was placed for a 50 percent occluded artery. I never was able to completely keep his pain gone for long without making him unstable in some other area; however, by morning I had learned the importance of my role as his cardiovascular RN. If I (or any nurse) had not been there to consistently check his status, he could have had a major cardiovascular event and may have needed more than just a stent.

The next section offers a discussion about the electrical system of the heart, including the specific pathway through the heart. The electrical system responds, as mentioned earlier, to the body's changes and responses to the ANS, and in accordance causes reactions from the mechanical system, in actions like cardiac pumping and vascular circulation.

Electrical Impulses

The human body includes an electrical system, which directly and indirectly affects all systems. Cardiac electrical impulses (Figure 18.10) lead to the mechanical (muscle) movement of the myocardium, which pumps and circulates blood through both systemic and pulmonary circuits, thereby (in normal circumstances) perfusing the entire system.

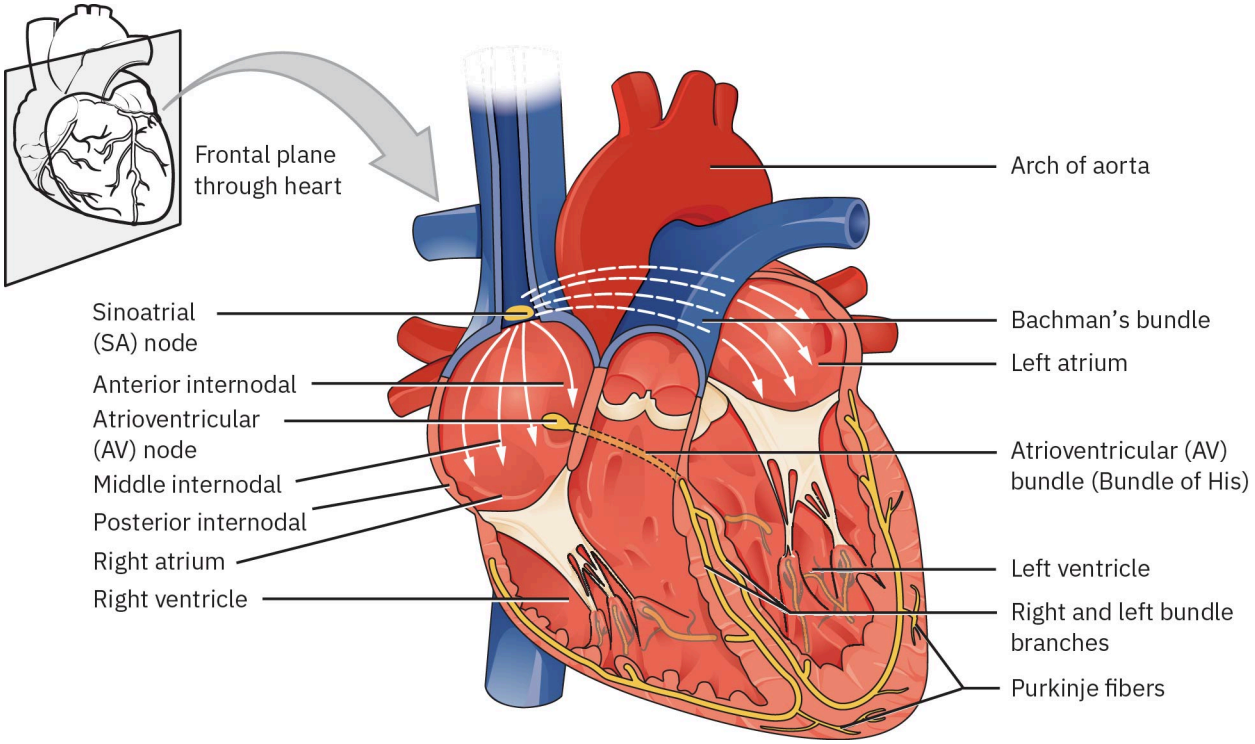


FIGURE 18.10 Normal electrical conduction through the heart travels from the sinoatrial node, to the internodal pathways, the atrioventricular node, the bundle of His, to the bundle branches (right and left), and to the Purkinje fibers. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Sinoatrial Node

Known as the pacemaker of the heart, the sinoatrial (SA) node has the highest rate of depolarization. It initiates the sinus rhythm or normal electrical pattern followed by contraction of the heart. Criteria for normal sinus rhythm include that the impulse begins at the SA node, travels from the SA node to the atrioventricular (AV) node in 0.12 seconds or less, and has a rate between 60 and 100 beats per minute. The firing of the SA node can be visualized by an **electrocardiogram** (ECG or EKG), which is a noninvasive test that involves attaching leads to a patient's chest and limbs: the machine then obtains a visual interpretation of the electrical impulses involved in the cardiac cycle (Figure 18.11).

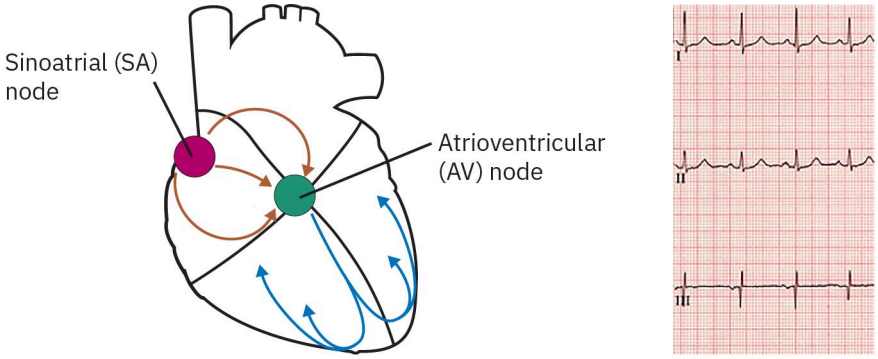


FIGURE 18.11 (a) Cardiac conduction from the SA node of the right atrium through the Purkinje fibers of the ventricles. (b) The associated rhythm as seen on an ECG is shown in the image. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Atrioventricular Node

Normal cardiac electrical signals originate in the SA node and travel next to the AV node, which is found in the right atrial wall close to the coronary sinus, and then the septum between the atria. The electrical impulse next travels to the bundle of His, which leads to bilateral ventricular contraction. The normal conduction rate at the AV junction is 40 to 60 beats per minute. In the event the SA node does not fire, the AV node is able to initiate an impulse. While

the slower rate is likely to be noticed symptomatically by the patient because of lower CO from both reduced HR and SV, it is often able to maintain an adequate HR and BP until a definitive intervention can be done.

Bundle of His

The bundle of His may also be referred to as the atrioventricular bundle, which helps identify its location and where it is in the cardiac electrical pathway. The bundle of His is composed of atrioventricular tissue, and it carries the electrical impulse from the AV node down the interventricular septum to the right and left bundle branches, which lead to the Purkinje fibers of the respective right and left ventricles. As the electrical impulse makes its way down the bundle branches and to the Purkinje fibers, it initiates the muscular action of ventricular contraction.

Dysrhythmia

The word **dysrhythmia** refers to a rhythm abnormality; the term arrhythmia indicates a lack or absence of rhythm but is often used synonymously with dysrhythmia to mean an abnormal rhythm. Dysrhythmias can be minor or extreme and life threatening, depending on where the anomaly originates, what it causes, and how extensive it is. One of the indicators of the severity of dysrhythmia is the patient's symptoms. Depending on a patient's medical history, level of well-being, mental state, and potentially other factors including the specific abnormal rhythm, there may be compensatory changes supporting little or no symptoms, or the patient may feel any combination of symptoms, including dizziness, weakness, syncope, palpitations, chest pain, or cardiac arrest.

Dysrhythmias have a variety of causes. A few examples are provided in the following paragraphs. Sometimes, irritable spots (foci) develop in the cardiac muscle where the property of automaticity may become a hindrance. This can lead to electrical misfires, as the irritable focus generates an impulse that may cause the normal electrical system to be interrupted, or the pathway altered.

Injuries to the heart or to a particular group of cells may also cause the normal electrical pathway to be disrupted, and slight changes or delays can develop, which are visible on ECGs when waves, intervals, and complexes are assessed and measured. An example is a first-degree heart block, where there is a delay in the period of time the impulse travels from the SA node to the AV node. On an ECG, this is seen as a prolonged PR interval.

Certain infectious diseases like bacterial endocarditis can lead to damage to the heart, including vegetations on valves causing valvular malformation, or an inability to open and close properly. This can produce disturbances in normal forward blood flow, which may be heard by auscultation with a stethoscope as a murmur.

Atrial fibrillation (A-fib) is a common dysrhythmia that sometimes is intermittent, may resolve on its own, or may respond well to treatment with medications or cardioversion. Sometimes, when interventions have not been successful in converting the patient out of A-fib, the goal becomes to minimize complications from inefficient atrial movement and subsequent increased risk for blood clot development. Medications like anticoagulants are used in this situation to prevent clot formation.

LINK TO LEARNING

More information on dysrhythmias, defibrillation versus cardioversion, and potential complications (https://openstax.org/r/77DysDefvsCard) is presented in this video.

Ventricular dysrhythmias are generally considered more dangerous than those originating in the atria, as the ventricles are integral in oxygenation and perfusion. These abnormal rhythms can be the result of a variety of influences, including illicit drugs like cocaine or methamphetamine, a traumatic injury such as being hit directly in the chest by a baseball, or as a consequence of a myocardial infarction (MI), where both electrical and mechanical tissue can be damaged.

Nurses are trained to respond to respiratory and cardiac emergencies, some of which are the result of dysrhythmias. This may include basic life support (BLS) training incorporating the combination of rescue breathing and chest compressions of **cardiopulmonary resuscitation (CPR)**. BLS instruction also includes the use of an **automated external defibrillator (AED)**, which is an easy-to-use portable device available in many settings that can analyze a cardiac rhythm and defibrillate, if appropriate, in order to reestablish an effective cardiac rhythm. It is noteworthy that AEDs identify heart rhythm but do not provide an option for the operator to view it; they are more designed for

bystander CPR response.

On patient care units within acute care hospitals, manual defibrillators are more common and offer portable monitoring on a small screen where medical providers can view and assess the patient's rhythm, as well as other features. Defibrillators provide shocks of the intensity to treat ventricular tachycardia or fibrillation but can also be set to deliver lower joules to attempt synchronized cardioversion for such dysrhythmias as A-fib. Additionally, the option to externally pace a patient is available on these devices. Newer manual defibrillators have an automatic AED option (Figure 18.12).

(a) (b)

FIGURE 18.12 (a) A manual defibrillator provides various options for monitoring, recording, and interventions, and (b) an AED is used for automated responses. (credit a: modification of work "Manual external defibrillator monitor" by "Aededitor"/Wikimedia Commons, CC BY 3.0; credit b: modification of work "AED & Fire Extinguishers, both necessary" by "David Bruce Jr."/Flickr, CC BY 2.0)

In **advanced cardiac life support (ACLS)**, extra training is involved, often for medical providers in prehospital and hospital settings, and this includes the addition of resuscitation and support cardiac medications. Commonly, these include drugs in the antidysrhythmic classification as well as those like catecholamines that increase BP—both of these classes of medicines are used in arrest circumstances to attempt to convert abnormal rhythms to normal, and/or enhance perfusion through other means.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety: Defibrillation

A hospitalized patient who suffers a ventricular fibrillation (VF) arrest is treated by a system of assessments, actions, and interventions, coordinating members of an interdisciplinary healthcare team, with QSEN Competencies in mind (QSEN, 2022). Associated competencies for the intervention defibrillation include patient-centered care, teamwork and collaboration (T&C), and safety (S). Considering the interdisciplinary nature of treatment of cardiac arrest, let us explore the knowledge, skills, and attitudes within the T&C competency through an unfolding example (QSEN, 2022):

1. **Knowledge**: "Describe scopes of practice and roles of healthcare team members" (p. 3).
   Example: VF arrest – code called by bedside RN, who immediately begins CPR while awaiting arrival of code team and equipment. Upon arrival of the team, there are predetermined roles based on scope of practice for the different professions. Team leader is typically a physician or advanced practitioner. BLS-certified personnel can alternate chest compressions every one to two minutes.
   Skills: "Function independently within own scope of practice as a member of the healthcare team" (p. 3).
   Example: The bedside nurse identified the arrest situation, called the code, and began CPR—all within the RN scope of practice. Others function within their professional scope as personnel converge on the patient setting, for example, RT begins bagging the patient during chest compressions by other personnel, team leader clearly states orders for interventions based on VF/cardiac arrest algorithm, education, and other skills, pharmacist provides ordered medications from the code cart as ordered, for the RN-assigned medication

administration.
Attitudes: "Value the perspectives and experiences of all health team members" (p. 3).
Example: The team members realize, understand, and practice their specific roles during an arrest situation. Collaboration between all members of the patient care/code team is respectful and values all members equally.

2. **Knowledge**: "Describe strategies for identifying and managing overlaps in team member roles and accountabilities" (p. 3).
Example: Hospital personnel, through BLS and ACLS certification/recertification, are practiced at the roles and responsibilities during emergencies. RNs assume roles including the primary nurse (whose patient is involved in the emergency), medication RN, recording RN—once the particular role is assumed, each of these nurses tends to continue that particular role throughout the event. RT provides bagging with the Ambu bag, followed by assisting with intubation, CO_2 confirmation, and placement of the patient on a ventilator. Various team members serve as compressors, providing chest compressions for one to two minutes at a time in relay format.
Skills: "Clarify roles and accountabilities under conditions of potential overlap in team member functioning" (p. 3).
Example: The primary RN role is changeable, based on nurse-patient assignments; an experienced team may have predesignated selections based on preference and experience/skill level, so the recorder may be the nursing supervisor, and the charge RN may administer medications. The team leader is usually a physician—intensivist or ED physician is common. As various members of the team provide chest compressions for short periods, transition from one compressor to another should be anticipated and verbally planned and executed for minimal disruption.
Attitudes: "Respect the unique attributes that members bring to a team, including variations in professional orientations and accountabilities" (p. 3).
Example: Team leaders tend to be those with advance practice background and prescriptive authority. The primary RN is considered to have the best familiarity with the patient—history, status trends, medications, and so on, and therefore can provide a quick overview. Various team members may be able to serve in more than one capacity, and clear communication is critical throughout an emergency, and in any transitions.
3. **Knowledge**: "Describe examples of the impact of team functioning on safety and quality of care" (p. 4).
Example: Treatment of a VF arrest includes early defibrillation. The prompt arrival of the code team, and the code cart with the defibrillator/monitor to confirm the rhythm, and subsequently treat it, are necessary. Placement of pads on the patient, activation of the machine, and its readiness for defibrillation when charged all must be clearly communicated throughout the event.
Skills: "Assert own position/perspective in discussions about patient care" (p. 4).
Example: Each team member's role is a critical part of the total situation, and the contribution is important and should be shared at appropriate times. A nurse may be responsible for pulse checks when chest compressions are briefly halted, and that nurse's input is vital at that time. Whether the patient has bilateral breath sounds after intubation is also key, and the RN or RT who auscultates the chest should distinctly state these findings.
Attitudes: "Appreciate the risks associated with handoffs among providers and across transitions of care" (p. 4).
Example: During an emergency circumstance like a cardiac arrest and code response, all members of the healthcare team should realize the importance of clear, concise communication among personnel. Whether this is to have a second physician join the team, or RT and an RN help with intubation and securing the endotracheal tube (ETT), or to change compressors after a minute or two of exhausting work, transitions should always maintain the central focus on the patient and clearly move from one situation or care provision to another.

Ischemia

A lack of O_2 delivery to a part of the body, especially the cardiac tissue, is termed **ischemia**. Angina pectoris is a rather common ischemic event whereby O_2 supply does not meet demand. Angina can be chronic and stable, in which case it is predictable, and patients are often able to treat it by discontinuing activity, resting, and administering sublingual nitroglycerin. If angina becomes unpredictable, it is described as unstable angina and is

associated with acute coronary syndrome (ACS), which involves worsening coronary disease. Ischemia is reversible if adequate perfusion is reestablished promptly. Coronary artery disease (CAD) can progress along a continuum, beginning with a healthy coronary system, to a diagnosis of stable angina pectoris, and to unstable angina. If it worsens and perfusion is inadequate for too long, it can advance to a MI. Once the tissue is damaged, terminology changes to infarction. Infarcted tissue does not recover and leads to permanent repercussions; a common adverse outcome of CAD is HF.

Heart Failure

Inefficiency of the heart's contractility characterizes HF. Ineffective contractility may arise from chronic hypertension, often associated with hypervolemia (fluid volume excess). According to Starling's law, the heart is capable of stretching muscle fibers, which initially improves the strength of muscle contraction and is a desired effect, as it increases SV. However, if this is a chronic situation, there can be a limit to this ability to stretch, and if exceeded, the cardiac muscle can become either hypertrophied (excessively enlarged) or unable to rebound from being overstretched, in which case the muscular walls become weak and floppy. Either circumstance reduces cardiac contractility, which is seen as HF symptoms, as seen in Figure 18.13.

LINK TO LEARNING

Watch for the signs, symptoms, and nursing assessment of right- and left-sided heart failure (https://openstax.org/r/77RigLefHeaFail) in this video.

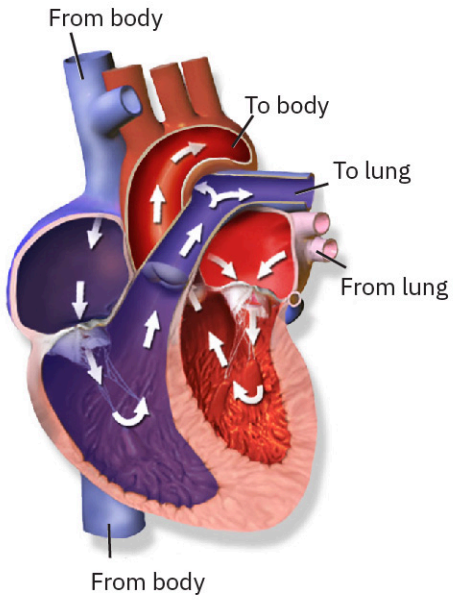
Right-sided heart failure		Left-sided heart failure
Often caused by left-sided heart failure; can also occur even when the left side of the heart is apparently normal		Most common type of heart failure; usually caused by coronary artery disease
Heart loses some of its ability to move oxygen-depleted blood to the lungs to pick up new oxygen		Heart loses some of its ability to pump blood out to the body after it has been reoxygenated
Symptoms: • Peripheral edema, especially ankles and feet (reduced venous return) • Hypervolemia/hypertension • Congestion in and around organs, e.g., liver • Ascites • Impaired liver function		Symptoms: • Cough, dyspnea, tachypnea • Orthopnea • Crackles/coarse breath sounds • Pulmonary edema • Lung field dullness on percussion • Diminished breath sounds at bases: pleural effusion • Cyanosis
		Subcategories: • **Systolic:** reduced EF as pumping ability of ventricle is diminished • **Diastolic:** ventricle becomes stiff & doesn't rest during diastole EF preserved but ventricular filling diminished

FIGURE 18.13 Right- and left-sided heart failure show different symptoms. (credit: modification of work "Blood Flow Through the Heart" by "BruceBlaus"/Blausen Medical Communication/Wikimedia Commons, CC BY 3.0)

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 7

Refer back to Chapter 15 General Survey, Anthropometric Measurement, and Vital Signs and Chapter 17 Nutrition Assessment for Unfolding Case Study Parts 1 through 6 to review the patient data. Mrs. Ramirez, a 68-year-old female, is brought to the emergency room by her husband. The patient reports shortness of breath with exertion and feeling "off" for the last three days. She was seen in the ED and has just been admitted to the medical-surgical unit for observation.

Past Medical History	Patient reports shortness of breath "gets worse with walking and only gets better after sitting down for at least fifteen minutes." **Medical history:** Myocardial infarction with stents ten years ago, HF, COPD, GERD, and hypertension. **Family history:** Married for fifty years, three grown children. Mother deceased from Alzheimer disease. Father alive, with hypertension and prostate cancer, currently undergoing treatment. **Social history:** Former pack/day smoker, quit twenty years ago. Social drinker, one drink/week. **Allergies:** None **Current medications:** • furosemide (Lasix) 40 mg PO daily • lisinopril (Zestril) 10 mg PO daily • carvedilol (Coreg) 6.25 mg PO twice daily • 81 mg aspirin PO daily
Assessment	**1900:** **Neurological:** Alert and oriented ×4, no deficits noted. **HEENT:** Symmetrical, no lesions noted. Jugular venous distension present at rest. **Respiratory:** Increased respiratory rate with labored breathing observed. Crackles in lung bases bilaterally. Patient reports dyspnea with exertion. **Cardiovascular:** Sinus tachycardia on monitor, S1 and S2 present, no murmurs noted. Capillary refill less than two seconds. Peripheral +1 pitting edema noted in bilateral lower extremities. **Abdominal:** Abdomen soft and nontender. Bowel sounds present in all four quadrants. Patient reports last bowel movement was yesterday. **Musculoskeletal:** 4/5 muscle strength in bilateral lower extremities. Limited range of motion in bilateral arms that patient reports is from old shoulder injuries. **Integumentary:** Skin warm and intact. Mild diaphoresis noted.
Flow Chart	**1930:** Blood pressure: 145/82 Heart rate: 115 beats/minute Respiratory rate: 29 breaths/minute Temperature: 99.6°F (37.5°C) Oxygen saturation: 89 percent on room air Pain: 3/10

1. Recognize cues: Based on the information presented in the case study, what are the most important cues for the nurse to recognize?
2. Analyze cues: Using the list of cues, identify which condition each would be associated with: hypertension, HF, and/or COPD. Note: Cues may be consistent with more than one diagnosis.
    - jugular venous distension
    - bilateral lower extremity edema
    - sinus tachycardia
    - oxygen saturation less than 90 percent
    - crackles in lungs
    - dyspnea on exertion
    - BP 145/82

18.3 Factors Affecting Cardiopulmonary Function

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Examine physiological considerations for impaired cardiopulmonary function
- Recognize lifestyle and behavioral pattern considerations for impaired cardiopulmonary function
- Remember diagnostic testing used to monitor cardiopulmonary functioning

In the upcoming section, pathophysiology is considered, as impaired cardiopulmonary function is examined. Nonmodifiable and modifiable influences can have significant impacts on cardiopulmonary function and are thus considered risk factors. Age and genetics are examples of nonmodifiable risk factors, as the alterations or changes to the cardiopulmonary system are unavoidable. Risk factors that are modifiable include behaviors and lifestyle choices, so whether a person is active and follows a diet that helps prevent negative cardiopulmonary changes is considered modifiable. Sometimes such positive behaviors are successful at halting or slowing processes like the development of hypertension, obesity, or hyperlipidemia.

In health care, it is often considered more beneficial to take a proactive approach and focus on the prevention of medical diseases and diagnoses, rather than waiting for a reactive response. Patients who have an understanding of their own health status and play an active role in their care are more inclined to seek preventive care and screenings, thereby avoiding preventable illness, or obtaining care early. Some such patients are able to minimize dysfunction of the cardiopulmonary system.

A variety of diagnostic tests assist healthcare providers in the identification of abnormalities, whether through preventive screenings or prompt recognition. Depending on the test, providers can monitor the progress of the disease or the effectiveness of treatment, whether medical, surgical, or pharmacological. Care plans can therefore be evaluated and redesigned based on individual patient status and goals of the patient and healthcare team.

Physiological Considerations for Impaired Cardiopulmonary Function

Homeostasis is a delicate balance, and minute changes can lead to slight or major changes physiologically. In the case of cardiopulmonary function, such alterations may affect either of the interrelated systems. Nonmodifiable risk factors for impaired cardiopulmonary function include advancing age, genetics, race, family history, and health status. Modifiable risk factors include physical inactivity, smoking, diet, and obesity.

Nurses need to anticipate such alterations and be prepared to act on changes. In many situations, proactive actions can make a huge difference, sometimes even more than reactive responses to an already symptomatic problem (Agency for Healthcare Research and Quality [AHRQ] PSNet, 2019). This section explores several factors that are likely to have effects on the cardiopulmonary system, followed by diagnostic testing that is used to monitor the function of this inescapably intertwined set of systems.

Age

Some cardiovascular changes within the heart, vessels, and blood occur naturally with age. Within the heart structure, the sinoatrial (SA) node can lose cells, and fat deposits and fibrous tissues can develop causing the SA node to fire at a slightly lower HR. In some people, enlargement of the left ventricle can occur with age, causing the chamber to hold less blood. Arrhythmias can develop, such as A-fib, caused by types of heart disease. Deposits of lipofuscin, degeneration of heart cells, and thickened heart valves can cause a heart murmur from turbulent blood flow within the heart.

In the blood vessels, baroreceptors can become less sensitive with aging, causing dizziness or orthostatic hypotension. Capillary walls may thicken, slowing the rate of exchange of nutrients and oxygen for waste and carbon dioxide. The aorta can thicken and stiffen, creating an increase in BP and cardiac hypertrophy.

A reduction in body water increases the viscosity of blood, causing a decrease in blood volume. Red blood cells are produced at a slower rate, delaying the body's response to anemia or blood loss. A decrease in neutrophils reduces the body's immune response to infection.

Aging also affects the pulmonary system. Aging lungs lose elastic recoil, causing small airway collapse and decreased alveolar surface area, decreasing lung compliance. Spirometry changes include a decrease in total lung

capacity, an increase in residual volume, and a decrease in the vital capacity of the lungs. In the chest wall cavity, conditions such as osteoporosis, arthritis, calcification of the thoracic spine, and changes to intercostal muscles can increase chest wall rigidity. The chest wall can become barrel shaped to compensate for a loss of lung elasticity, causing the diaphragm to flatten and become less efficient.

Genetics

There are genetic disorders that affect the pulmonary and/or cardiovascular systems. Research has identified several such inherited cardiovascular diagnoses and described them as vascular, cardiomyopathies, or involving arrhythmias (Musunuru et al., 2020). For example, elevated lipids can be difficult to treat for some individuals; familial hypercholesterolemia may be the genetic source of this dyslipidemia.

A rather common example of a vascular genetic disorder is Marfan syndrome, which is often associated with excessive height and other long bones like those of the hands and feet. However, Marfan syndrome also frequently impacts blood vessels, including the aorta. The risk of aortic aneurysm and possible dissection is a major concern with this genetic diagnosis (Musunuru et al., 2020). Another genetic disorder, Loeys-Dietz syndrome, is similar to Marfan syndrome, as it impacts connective tissues and can cause aortic aneurysm and potential dissection.

Long QT syndrome and bradycardia syndrome are arrhythmias associated with genetics, although there are other possible causes, including certain medications (Musunuru et al., 2020). Genetic cardiomyopathies include several of the muscular dystrophies, including Duchenne, limb-girdle, and Emery-Dreifuss. Dilated and hypertrophic cardiomyopathies can also be rooted in genetics.

More than sixty genes have been identified as involved in at least a dozen pulmonary syndromes (Brigham and Women's Hospital, 2023). One of the most common breathing disorders is asthma, and for some sufferers, the cause is genetic. Many of the pulmonary syndromes are rather rare. Pulmonary syndromes are distinguished by those associated with cysts (causing the formation of abnormal cysts), **fibrosis** (causing abnormal, scar-like tissue), or **bronchiectasis** (causing dilated airways).

While rare and involving organs other than the lungs, cystic fibrosis (CF) is perhaps best recognized as a lung disorder; it is considered a bronchiectatic syndrome (Brigham and Women's Hospital, 2023). CF causes mucus to become thick and sticky, with respiratory secretions among those affected; this can cause airway limitations and difficulty breathing. Pulmonary fibrosis and pulmonary hypertension are both fibrotic genetic disorders. Alpha-1 antitrypsin deficiency is a genetic cystic pulmonary disorder that affects the lungs and potentially the liver. Alpha-1 antitrypsin deficiency involves symptoms similar to those of emphysema, and indeed patients may progress to an emphysema diagnosis (Brigham and Women's Hospital, 2023).

Health Status

The status of one's health at baseline can be critical for outcomes when faced with any sort of alteration of normal physiological function. Those people who are generally healthy when there is a challenging event, whether illness, injury, or emotional stress, have a far better chance of confronting the event with little physiological decline or residual effect. Conversely, someone whose baseline is poor health, as reflected by multiple **comorbidities** (multiple medical diagnoses), is at a disadvantage as far as withstanding the challenging event.

The **metabolic syndrome** is an example of a cluster of diseases (including hypertension, high blood sugar levels, a large waistline or apple shape, high triglycerides, and low HDL cholesterol) that occur together, increasing the likelihood of developing heart disease. Some patients are not identified as having the syndrome, as they experience only one or two of the diagnoses. There are certain disorders that commonly cluster together like those of metabolic syndrome, with the possibility of additive effects from the multiple disorders identified. Several comorbidities have been identified with frequent prevalence in patients with cardiopulmonary disorders. The four cardiopulmonary diagnoses isolated in this research were HF, peripheral arterial disease (PAD), coronary heart disease (CHD), and stroke. DM, COPD, and low vision were identified as the comorbidities with the most statistically significant impact on the development of the disorders.

The interaction of comorbidities and their contribution to the diagnoses can be exemplified (Buddeke et al., 2019):

- DM is also associated with the development of microvascular damage, which can play a part in vision problems, as well as hypertension and PAD.
- Hyperlipidemia is a frequent contributor to intravascular plaque development, hypertension, and ultimately

significant heart disease that may lead to MI and/or stroke. MI is a common cause of HF.
- COPD is often associated with cigarette smoking; impaired gas exchange is one of the common results. The cardiovascular system is also likely to be impacted, resulting in MI and/or stroke.

Medications

Medications are prescribed for any number of reasons, and they are not without potential for problems. Drugs have desired effects and side effects. Sometimes, side effects are negative or even dangerous, referred to as adverse effects. Following are some examples of medications that have the potential to negatively affect the cardiovascular or pulmonary systems, or both.

Often, medications to treat one problem can lead to another. An example is the antidysrhythmic class of drugs. Most of these drugs are accompanied by a warning they may cause other dysrhythmias. Amiodarone is one such drug, as there is a risk for cardiac rhythm changes. Amiodarone may also affect the pulmonary system, with pulmonary fibrosis (Penn Medicine, 2023) and acute respiratory distress syndrome possible.

Chemotherapeutic agents, typically for the treatment of cancers, are associated with many side and adverse effects, some of which can be very uncomfortable or toxic to body systems. Cyclophosphamide, an alkylating antineoplastic is one such drug, with the potential to cause pulmonary fibrosis and cardiotoxicity. While cyclophosphamide's impact on the cardiac system is considered reversible, another cardiotoxic chemotherapy drug, daunorubicin, has a cumulative effect with dosing, and therefore a maximum dose. To avoid cardiac problems such as HF, daunorubicin is carefully considered with regard to the type of cancer, type of previous treatment, and total dose administered in the past.

Lifestyle and Behavior Patterns

Lifestyle and behavior patterns include decisions people make about dietary choices, habits they acquire, activities they involve themselves in, and the level of activity in which they participate. Such behaviors have a significant influence on health and wellness in a general and holistic way, and certainly, there are important considerations when one looks particularly at the cardiopulmonary system. As mentioned previously with discussion of overall health status, there are a variety of pathophysiological changes and medical diagnoses that are more likely to occur when certain lifestyles are lived and behaviors are selected, especially when these are habitual and/or frequent.

Smoking contributes to a number of diseases of the lungs, heart, and vessels. Constant exposure to chemicals in the lungs, mouth, and larynx can cause abnormal cells to divide and cause cancer. Smoking causes a disruption of the mucociliary elevator in the lungs, which can lead to increased colonization of bacteria in the lower respiratory tract and frequent infections. It also causes atherosclerosis, increasing a person's chances for CHD, hypertension, stroke, peripheral artery disease, and abdominal aortic aneurysm (CDC, 2020).

PATIENT CONVERSATIONS

Teen Vaping

Scenario: Patient is a 15-year-old named Richard, who has been vaping for the past year. The patient has been to see the primary care provider on a monthly basis for "a cold" that doesn't improve, over the past four months.

Patient: I suppose you're going to lecture me.

Nurse: I doubt lecturing will be helpful. Unless you think it would be.

Patient: My parents gripe at me all the time about it. Doesn't do anything. Just makes me more pissed off.

Nurse: Exactly.

Patient: Yeah. Won't do anything.

Nurse: What I would like to do is tell you a bit about the cold you've had so long, that won't go away.

Patient: Yeah. Why won't the doctor give me something to fix it?

Nurse: That's the problem. What you've got going on is not a cold, but what your body's doing from the vaping. It

looks like your lungs aren't happy about this, and what seems like a cold is your lungs trying to recover after each time you use your vape pen.

Patient: But my friends don't have any problems with it.

Nurse: Maybe they don't yet. Or maybe some of them never will. But the problem is, you're here today and have been before because *your* lungs aren't taking it well. And what the doctor can do is help you cut down and stop if you'll give it a chance. If today's not the day, I'd like to ask you to come in again to see me in a week. That way, you can think about it, read this pamphlet, and if you have questions, write them down. I'll answer them next week.

Patient: It probably won't help, but I'll take the paper and see you in a week.

Choices about one's diet are also major contributors to pathophysiological changes, and this can be from deficits or excesses. Some people make decisions about avoiding certain foods and end up with disorders related to certain nutritional deficits. Electrolytes are a good example of nutrients that, like acid-base balance, must be maintained within the established window of normal ranges for proper metabolic function. Sodium is an electrolyte often first considered for its concerns when levels are high or low. Either abnormality may present with neurological changes, perhaps some mild confusion, but can be far more extreme, and/or long lasting. Sodium retention is associated with water retention, so elevated plasma sodium tends to cause hypervolemia and hypertension. Potassium can cause devastating problems if it is not kept in range: if elevated or decreased, minor symptoms may be apparent, or ultimately dysrhythmias are possible, and may be deadly. Phosphate is another electrolyte and is often overlooked for its importance in metabolic function. Recall that cellular energy involves ATP, and the P is phosphate. Therefore, without adequate levels of phosphate, ATP production is reduced. With functions as critical as those of the respiratory and cardiac systems, a constant supply of energy is necessary.

Perhaps more often considered as a nutritional abnormality is overconsumption, especially when the proper combination of necessary nutrients is not part of the diet. Rather, consumption is not only excessive but may involve improper dietary intake, such as sweetened beverages and snacks, high-sodium meals and snacks, and a lack of balance of essential dietary sources. This results in not only higher weight but also malnutrition. Overeating and subsequent higher weight may involve hyperlipidemia or be associated with hypertension or type 2 DM. Or it may be related to excessive sodium intake, and associated fluid retention and hypertension.

Physical Activity Level

One of the behaviors with an impact on cardiopulmonary function is physical activity. At least 150 minutes of moderate aerobic exercise activity weekly is recommended by the AHA (2023) to maintain and possibly improve health status and avoid complications. The success of the AHA recommendations appears to lie in patients making exercise habitual and incorporating other healthy living activities into these new lifestyle choices.

Improved circulation is one of the major benefits of increased activity, as it maximizes oxygenation and perfusion, and all body systems reap the benefits, from improved neurological function to enhanced elasticity of blood vessels and improved BP, to normalizing lipid levels and reducing atherosclerotic plaque formation and CAD.

LINK TO LEARNING

The AHA provides various resources about healthy living (https://openstax.org/r/77hearthealthy) that can be used in patient education.

Cultural Influences

Whether conscious of it or not, cultural influence is within the very fabric of people's lives. From birth, it surrounds people, and throughout the life span, it influences and guides relationships and decisions in so many ways. With regard to the cardiopulmonary system, culture may have effects on acceptance of medical advice and the healthcare system, dietary choices and traditions, how and what activities are accepted and utilized, emotional and societal support systems, and stress levels (Acare Pro, 2023).

Culture determines dietary habits. Many people in the United States, for example, continue the practice of consuming meals with meat as the primary component, potatoes or another starchy carbohydrate as a major side

dish, and a small helping of vegetables. This high-calorie diet, combined with a sedentary lifestyle, increases the likelihood of weight gain; higher weight is a risk factor for cardiovascular disorders.

Adding spices for flavor is another example of cultural influence, with some adding hot and savory spices, while others minimize additive flavors. Salt is an extremely common and popular spice, and processed foods like lunch meats and canned soups tend to have high sodium content, which is contraindicated for some, particularly with cardiac conditions like hypertension and HF.

Some cultures embrace complementary alternative medicine practices, while others are more skeptical. Herbal remedies, and the notion of whether a food or beverage should be consumed at a certain temperature, are important in certain cultural settings (Acare Pro, 2023). Some drugs may be recommended to be taken on an empty stomach, or with food, and cultural influences may interfere with either medical instruction. Communication is impactful herein, as misunderstandings are possible and lead to a lack of treatment and worsening of the health condition.

While the likelihood that the exploration of influences of culture upon health status, and cardiopulmonary health in particular, could continue with many more exemplars, the final example here is that of medical care. Cultural perspectives prompt a variety of attitudes about health care (Acare Pro, 2023): is it embraced openly and fully, or approached with extreme caution? This may be demonstrated by whom patients choose for their health care. Do they require their provider to be a well-educated physician, a naturopathic practitioner, or a neighborhood healer whose training was obtained informally but is well accepted in the area? The preference and selection as to which expertise is sought may be from cultural mores over years or perhaps even decades or longer. If patients are distrustful of medical practitioners, they are again less likely to follow recommended treatment plans.

Environmental Influences

Environmental stressors can have a negative impact on cardiopulmonary health. Living in the city can intensify these stressors. Examples of environmental stressors include air pollution, noise and light pollution, wildfires, and climate change (Münzel et al., 2021). The cardiovascular and pulmonary systems are both susceptible to these environmental influences.

Noise, especially that related to traffic, can possibly increase the risk of hypertension, MI, and stroke (Münzel et al., 2021). The premise is related to the stress response, with increased release of cortisol and catecholamines causing the signs and symptoms associated with stress. This includes SNS stimulation and often results in elevated HR and BP. If sustained, such stress-associated manifestations have the potential to lead to MI and stroke. Climate change is also implicated in contributing to stress-related changes, such as cardiac strain and sleep disturbances, as well as inflammatory responses to airborne pollutants such as dust and wildfire smoke (Münzel et al., 2021).

Air pollution is identified as a contributor to cardiovascular disease itself, as sources such as automobile exhaust or burning of fossil fuels release chemicals into the air (Münzel et al., 2021). Such chemicals can cause mild irritation or an allergic response or may be toxic and lead to inflammatory and immune responses, and infections. With long-standing exposure, CAD can develop, with the risk of ACS including MI and ultimately HF or death. Dysrhythmias and stroke are also potential results from exposure to air pollutants.

Environmental influences on the pulmonary system focus on a variety of means of damaging lungs through accelerated aging and reducing cellular healing abilities (Eckhardt & Wu, 2021). Means of pulmonary damage include inflammation, oxidation, damage to DNA, and cellular dysfunction, including impaired healing. Environmental exposures may also cause allergic responses, which can vary from mild to severe.

Environmental exposures to such substances toxic to the respiratory system include tobacco smoke, combustion of fossil fuels, and automobile exhaust. Tobacco smoke contains numerous chemicals, which can cause mild results like inflammation or may be carcinogenic. Burning of fossil fuels releases sulfur and nitrogen dioxide (among other chemicals), which contribute to pulmonary damage (Eckhardt & Wu, 2021). Employment-related exposure may also include populations who mine granite or sandstone and are therefore exposed to silica dust, and coal miners, who are exposed to coal dust and at risk for pneumoconiosis (“black lung”). Mesothelioma is another possible lung disorder related to environmental exposure to asbestos.

Diagnostic Testing Used to Monitor Cardiopulmonary Functioning

As varied as the potential dysfunctions of the cardiopulmonary system may be, so too are the diagnostic tests used to determine what is happening with a patient, and the extent of the dysfunction(s). Such testing may be invasive or noninvasive, may concentrate on the cardiovascular system or the respiratory system, and may provide information about general function (or lack thereof), infection, or injury.

Cultures

Cultures are obtained to identify whether an infection of some sort is present by growing particular microbes in the laboratory. Varied sources can be cultured, including samples of blood, sputum, urine, or swabs from a wound or throat (MedlinePlus, 2023). Not only can cultures verify the presence of bacteria in general, but identification of which bacteria are present is typically provided. Other microbes may also be cultured, including mycobacterium (the specific type of bacteria that causes tuberculosis), viruses, and fungi.

Cultures are routinely allowed to grow for forty-eight to seventy-two hours; particularly virulent microbes often grow quickly and are clearly identified within forty-eight hours. To ensure accuracy in results, some cultures are grown for longer periods. Examples include bacteria cultures incubated for up to five days, fungal cultures for up to four weeks, and mycobacterial cultures for three to eight weeks (Van Leeuwen & Bladh, 2023).

In addition to culture, for treatment purposes, sensitivity is often ordered. This offers identification of a particular bacteria and exposes the microbes to various antibacterial drugs to distinguish the drugs that are effective, most effective, or ineffective in reducing or eliminating the microorganism(s). For what is anticipated to be a simple infection, the healthcare provider may order merely a culture, but sensitivity results can be extremely helpful in narrowing broad-spectrum antibacterials to effective but narrower-spectrum drugs. Hospitalized patients frequently have complicated infections, and bacterial resistance is a reality, so it is common for healthcare providers to order the culture and sensitivity (C&S) at the time of the original order.

Blood

Blood cultures are ordered when sepsis is suspected. In many facilities, laboratory personnel draw blood samples for blood cultures to avoid contamination of the sample. With some infections, pathogens are only found in the blood intermittently, so a series of three or more blood cultures, as well as blood draws from different veins, may be performed to increase the chance of finding the infection.

Blood cultures (Figure 18.14) are incubated for several days before being reported as negative. Some types of bacteria and fungi grow more slowly than others and/or may take longer to detect if initially present in low numbers.

FIGURE 18.14 Blood collection bottles can be used for aerobic and anaerobic cultures. (credit: modification of work "Blood Culture Bottles" by "Moose G."/Flickr, CC BY 2.0)

A positive result indicates bacteria have been found in the blood (bacteremia). Other types of pathogens, such as a fungus or a virus, may also be found in a blood culture. When a blood culture is positive, the specific microbe causing the infection is identified, and susceptibility testing is performed to inform the healthcare provider which antibiotics or other medications are most likely to be effective for treatment.

Sputum

A sputum culture is a diagnostic test that evaluates the type and number of bacteria present in sputum. The patient is asked to cough deeply and spit any mucus that comes up into a sterile specimen container. The sample is sent to a laboratory where it is placed in a special dish (Figure 18.15) and is watched for two to three days or longer to see if bacteria or other disease-causing germs grow. Acid-fast bacillus testing, along with C&S testing, is used to diagnose tuberculosis (TB). When testing for TB, at least three consecutive samples are collected, with at least one being an early morning sample.

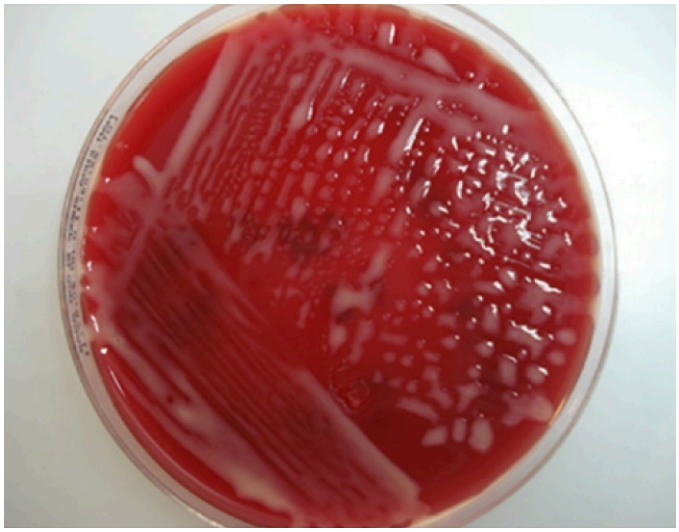


FIGURE 18.15 An image of a sputum culture, which can be used to diagnose diseases like TB. (credit: modification of work by National Library of Medicine; CC BY 3.0)

Blood Gases

Blood gases are done to acquire information as to a patient's oxygenation and acid-base balance. This includes pH, partial pressure of CO_2 ($PaCO_2$), partial pressure of O_2 (PaO_2), O_2 saturation (SaO_2), bicarbonate (HCO_3), and base excess (the amount of base present in the blood).

Blood gas samples are drawn with a specific heparinized syringe that only needs a small sample of blood. In years past, the syringe had to be placed on ice and sent to the laboratory for testing. Now it is more common to use a point-of-care device called an iSTAT. From the syringe, blood is placed into the receiving area of an iSTAT cartridge, which is then placed into the analyzer. Within approximately two minutes, the results are available.

Arterial

Arterial blood gases (ABG) are measured by collecting blood from an artery, rather than a vein, and are most commonly collected via the radial artery. Acquiring an ABG requires training and is often painful for the patient. Therefore, this test is not done on a routine basis and is not typical for a stable patient. In severe illness, however, with a patient whose O_2 status is questionable or at risk, the information from an ABG can provide the necessary results for guiding immediate care and planning ongoing interventions.

While some components of blood gas testing are closely correlated between an arterial and venous sample, those indicative of oxygenation ($PaCO_2$, PaO_2) are most reliable if the source is arterial (Lentz et al., 2019). Acid-base information: pH, HCO_3, and base excess (or deficit) demonstrate a reasonable correlation between arterial and venous samples. For accuracy in the results of bicarbonate, a plasma sample for specific chemistry should be obtained, as it is not a measured value as part of a blood gas (Lentz et al., 2019).

PATIENT CONVERSATIONS

ABG

Scenario: The patient is Gloria, who is 74-years-old; her history includes emphysema and frequent urinary tract infections. She was brought to the hospital by her son, who found her sitting in her recliner, very confused. She is now in the ICU, and the nurse is preparing to draw an ABG. Her son, Reggie, is in the room with her.

Nurse: Gloria, I need to get a blood sample from your wrist.

Patient: MmmHmm. Oh, what? Who?

Nurse: I'm going to put a needle in your wrist for a blood sample. Reggie, would you sit on that side of her and hold her hand?

Patient's son She already has an IV in her arm. Won't that work?

Nurse: This is different, this sample has to come from her artery. I want to use the one on the inside, where we often feel for a pulse, the radial artery. This will tell us more about why she was so quiet and confused when you found her, and why she's still like that. And if her emphysema is worse now.

Patient's son Oh, okay. I think she had that last time. She was on a respirator, you know, about three months ago. Her breathing got real bad.

Nurse: Yes, I'll bet you're right. She probably had this done then, too. So, I'm going to draw from her right side, and if you can just hold her left hand and let her know you're here. Try to keep her still, so she doesn't jump or pull away when she feels the stick. The results only take a couple of minutes, so we'll have a better idea of things when I call the doctor with the results. Thanks for your help.

Venous

Venous blood gas (VBG) acquisition is considered less painful than an arterial sample; veins tend to be more superficially located and are often visible and/or palpable. Arteries are deeper and the puncture for an ABG is done blindly, based on palpation. Occasionally, while attempting an ABG, a venous sample is accidentally obtained, or a mixture of arterial and venous blood. In such a circumstance, the results may provide inadequate information. Because a VBG is less painful to draw, if the physician is attempting to determine acuity versus chronicity,

hypercarbia, or whether the problem has a respiratory or metabolic cause (Lentz et al., 2019), a VBG may be ordered.

Cardiac Biomarkers

There are three major cardiac biomarkers: creatine kinase (CK), troponin I, and creatine kinase myocardial band (CK-MB). CK-MB and troponin I are the two tests commonly ordered when a MI is suspected, or an exacerbation of HF. CK-MB is elevated within four to six hours after an MI, peaks within twenty-four hours, and normalizes within seventy-two hours (Van Leeuwen et al., 2023). Troponin I levels rise between two and six hours post-MI, followed by two peaks—the first between fifteen and twenty-four hours postinjury, and again at sixty to eighty hours after injury.

Another cardiac biomarker that is used to diagnose HF is the brain natriuretic peptide (BNP). BNP is used not only for initial diagnostic purposes but also to manage ongoing treatment, assess progression of HF, and evaluate patients during exacerbations (Van Leeuwen & Bladh, 2023). BNP rises when a stretch of the heart occurs from hypervolemia, and so as the congestive nature of HF increases, so does this peptide.

Capnography

Two methods are used to monitor ventilation and oxygenation: **capnography** (the amount of CO_2 at the end of exhalation) and pulse oximeter, respectively. Since capnography measures exhaled CO_2, it is also referred to as end-tidal CO_2 ($ETCO_2$); the normal range is 35 to 45 mm Hg (Sullivan, 2020). Commonly, patients whose medical condition indicates the necessity for $ETCO_2$ monitoring are critically ill. Patients in low perfusion states (e.g., shock, hypovolemia) may be candidates for capnography, as healthcare providers are seeking specific information about ventilatory status and the ability of the tissues to access circulating O_2. It can also be a helpful tool for monitoring interventions and modifying treatment promptly (Sullivan, 2020).

Capnography can be done with a special type of nasal cannula, which can deliver O_2 and obtain $ETCO_2$ results. Or the nasal prongs can be in place while a patient is receiving O_2 by mask (simple, continuous positive airway pressure [CPAP], or nonrebreather). There is also an attachment that can be used in conjunction with the ventilator for mechanically ventilated patients to be continuously monitored. There are specific monitors for $ETCO_2$, whether static or portable, and specific settings, as capnography is done by anesthesia providers during surgery, and in ICUs it is monitored by nurses in addition to continuous monitoring of other vital functions, like pulse oximetry, RR, HR, and BP. The waveform depicts the respiratory cycle and indicates the amount of CO_2 at each phase (Sullivan, 2020). Waveform variations (Figure 18.16) from the rather square shape of normal indicate likely pathophysiological changes, like pulmonary embolism, pneumothorax, or airway obstruction (Duckworth, 2017).

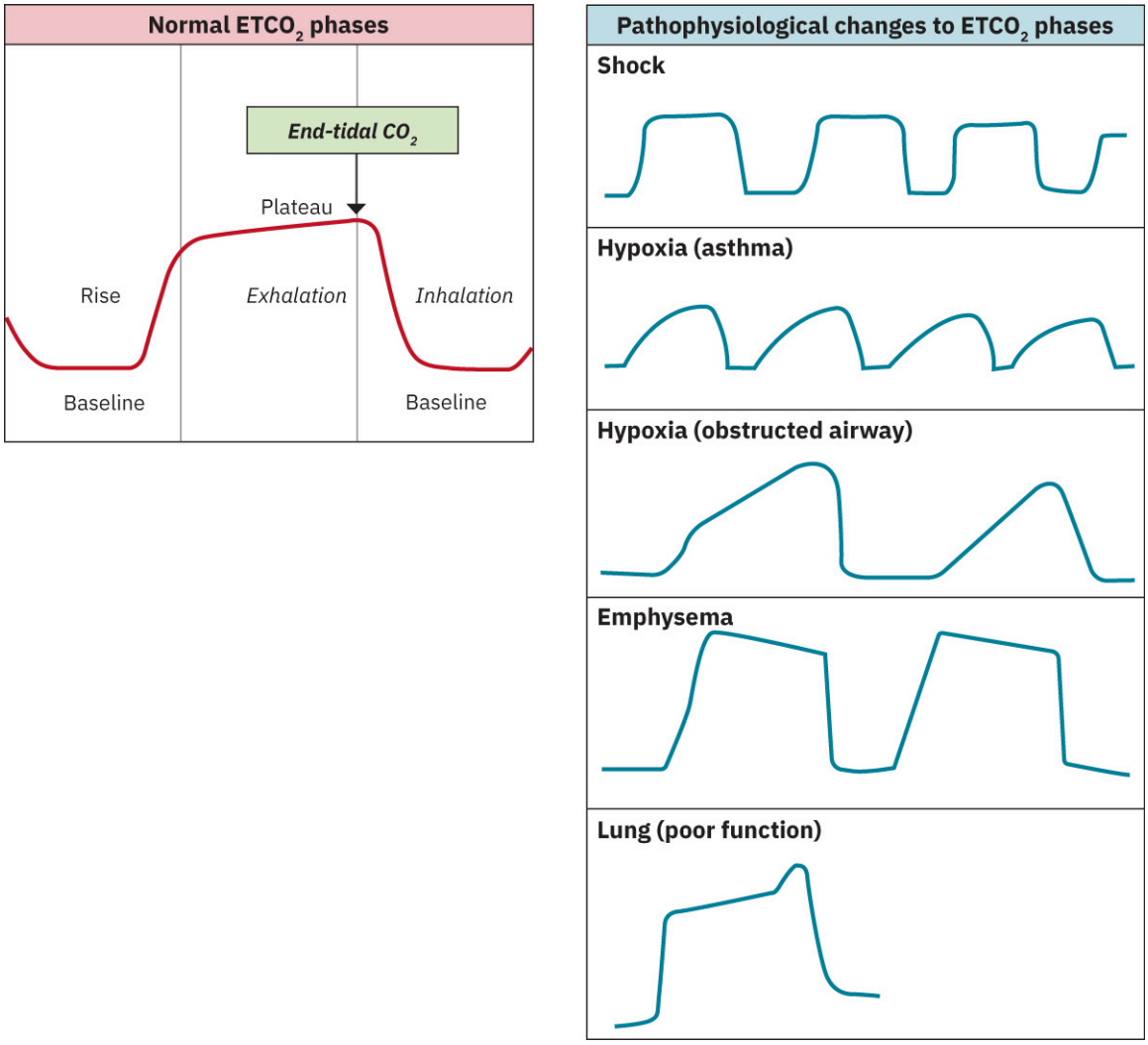


FIGURE 18.16 Normal $ETCO_2$ waveform and respiratory phases and variations to the waveform in different pathophysiological conditions. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Pulse Oximetry

To understand pulse oximetry, it is important to recall the hemoglobin molecule and its relationship to O_2. Hemoglobin is a molecule within red blood cells, and each of these molecules can carry four molecules of O_2. A pulse oximeter is a noninvasive device (Figure 18.17) placed on the finger that is able to read this saturation of hemoglobin using light. It is portable in many settings, including available for home use, or attached for continuous monitoring in settings like emergency departments, ICUs, or operating rooms.

FIGURE 18.17 A portable pulse oximetry device that goes on a patient's finger. (credit: Untitled by "MIKI Yoshihito"/Flickr, CC BY 2.0)

A normal saturation at sea level is 94 to 98 percent. At elevation, it may be acceptable for patients' pulse oximetry to be lower, yet still be considered normal. Also, certain pathophysiological changes affect pulse oximetry or have effects on what percentage is desired for a particular patient. In patients with COPD or emphysema, a normal oxygen level is 88 to 90 percent, because lung disease causes a lower O_2 and higher $PaCO_2$ balance. A patient who has experienced blood loss after a surgery or traumatic injury or is anemic because of a disorder like iron deficiency may have a lack of O_2 being circulated because there is a lack of carriers.

LINK TO LEARNING

A demonstration of teaching a patient how to use a peak expiratory flow rate (PEFR) for monitoring asthma (https://openstax.org/r/77PEFRTeachPat) is presented in this video.

Pulmonary Function Studies

To help diagnose respiratory dysfunction and determine whether a problem is restrictive or obstructive, pulmonary function tests (PFTs) may be performed (Figure 18.18 and Table 18.3). A restrictive disorder is when air has difficulty flowing out of the lungs, and an obstructive disorder is when the movement of airflow is restricted by the inability of lung tissue and/or chest wall to expand. The results of PFTs are dependent on the effort of the patient, and results should be considered with the patient's history when reaching a diagnosis (Ponce et al., 2022).

FIGURE 18.18 A nurse sets up a pulmonary function test for a patient. (credit: Untitled by Deidre Smith/Naval Hospital Jacksonville/Navy Medicine/Flicker, Public Domain)

Type of Test	Lung Volumes	Tests	Results
Spirometry Device: Spirometer • Measures amount and speed of air inhaled/ exhaled • Data collected to computer • Records results on graph paper Process: • Nose clipped closed • Patient breathes into mouthpiece at three phases: 1. Maximal inspiration 2. Burst expiration 3. Continue to exhale until end of test Use: • Establish baseline for future comparison • Compare to previous for follow-up on disease process (improvement or deterioration)	• Tidal volume (TV or VT): The volume of air inhaled or exhaled during normal breathing • Functional reserve capacity (FRC): The volume of air left in lungs after normal exhalation • Vital capacity (VC): The total volume of air that can be exhaled after maximum inspiration • Forced vital capacity (FVC): The volume of air exhaled as powerfully and quickly as possible • Forced expiratory Volume (first second) (FEV1): The volume of air expired during the first second of forced expiration • FEV1/FVC Ratio: Ratio of FEV1/FVC • Expiratory Reserve Volume (ERV): The volume of air maximally exhaled after end-inspiration • Residual volume (RV): The volume of air left in the lungs after maximum exhalation • Total lung capacity (TLC): The total volume of the lungs at the end of maximum inspiration • Inspiratory Reserve Volume (IVR): The volume of air that	FRC results can be used to estimate results of other volumes FEV1 classifies the severity of obstructive lung diseases based on percent of predicted values. FEV1/FVC ratio helps distinguish obstructive from restrictive lung disease With FEV1/FVC ratio, TLC can be used to evaluate restrictive lung disease	FEV1 greater than 70 percent predicted = MILD disease 60 to 69 percent = MODERATE disease 50 to 59 percent = MODERATE to SEVERE disease 35 to 49 percent = SEVERE disease Less than 35 percent = VERY SEVERE disease FEV1/FVC ratio greater than 0.70 with TLC less than 80 percent predicted value indicates restrictive lung disease

TABLE 18.3 Pulmonary Function Testing (Johns Hopkins Medicine, 2023a; Johns Hopkins Medicine, 2023b; Ponce et al., 2022.)

Type of Test	Lung Volumes	Tests	Results
	can be maximally inhaled from end-inspiratory tidal breathing		
Peak Expiratory Flow Rate Device: Peak Flow Meter (PFM) Process: Exhale forcefully into PFM	Peak expiratory flow rate (PEFR): The fastest rate that air can be exhaled	PEFR assists patients to manage lung diseases (e.g., asthma, emphysema, chronic bronchitis) Guides as to disease progress/current status	Results use system of traffic light: GREEN—Go: Continue current treatment(s) YELLOW—Caution: Call healthcare provider with results from PFM RED—Stop/Emergency: Use rescue inhaler Call HCP Go to ED

TABLE 18.3 Pulmonary Function Testing (Johns Hopkins Medicine, 2023a; Johns Hopkins Medicine, 2023b; Ponce et al., 2022.)

LINK TO LEARNING

Learn more about PFTs and associated terminology, reasons, and risks (https://openstax.org/r/77PFTsInfo) at this website.

Electrocardiogram

ECGs use a special type of paper, which looks rather like fine graph paper: the horizontal lines indicate the passage of time, with each small box representing 0.04 seconds and each larger box, which contains five small boxes, indicating 0.2 seconds. The vertical lines indicate electrical voltage. When an ECG tracing is viewed, there is a line established that indicates a straight passage of time: measurements of components of the cardiac cycle are made based on deflection and return from and to this line. This is referred to as the **isoelectric line** or baseline. Most commonly, nurses note whether the inflection rises from the isoelectric line or has a downward path, or a combination of both. The voltage is not necessarily routinely measured (Figure 18.19).

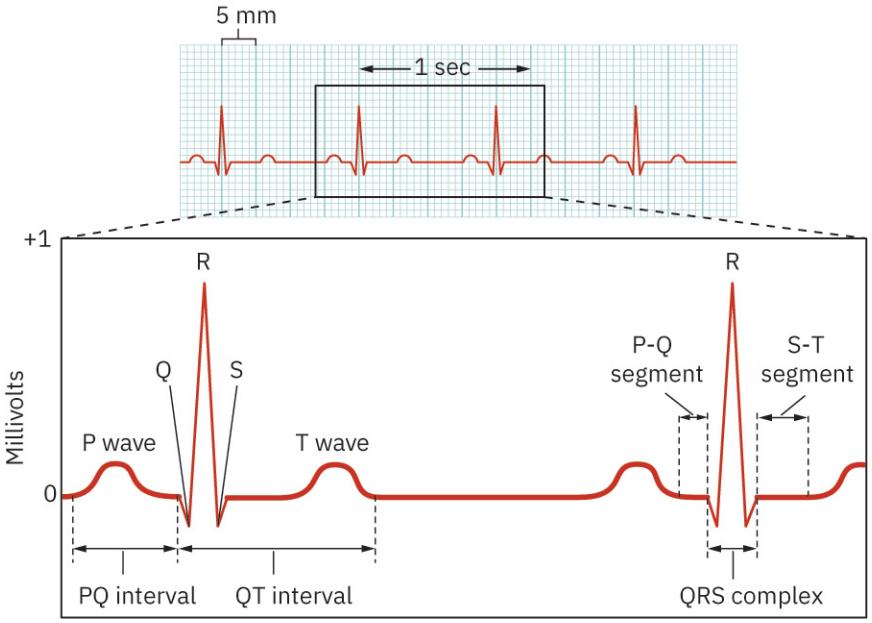


FIGURE 18.19 Electrocardiogram tracing including waves, complexes, segments, and intervals. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Nursing education programs provide introductions to cardiac rhythms—the depth of information depends on the type of program and other specific requirements. In settings like the ED, ICU, telemetry, and postanesthesia care unit (PACU), nurses are educated to recognize normal and abnormal traits of the cardiac cycle and, depending on facility policy, to provide a **rhythm strip** (six-second tracing of one or two leads from a continuous monitor), with measurements to indicate any noted abnormalities in conduction.

The electrical impulses in the heart produce electrical currents that flow through the body and can be measured on the skin using electrodes. This information can be observed as an electrocardiogram (ECG), a recording of the electrical impulses of the cardiac muscle (Figure 18.20). ECGs are extremely valuable for diagnosis and guiding treatment of patients with cardiac symptoms.

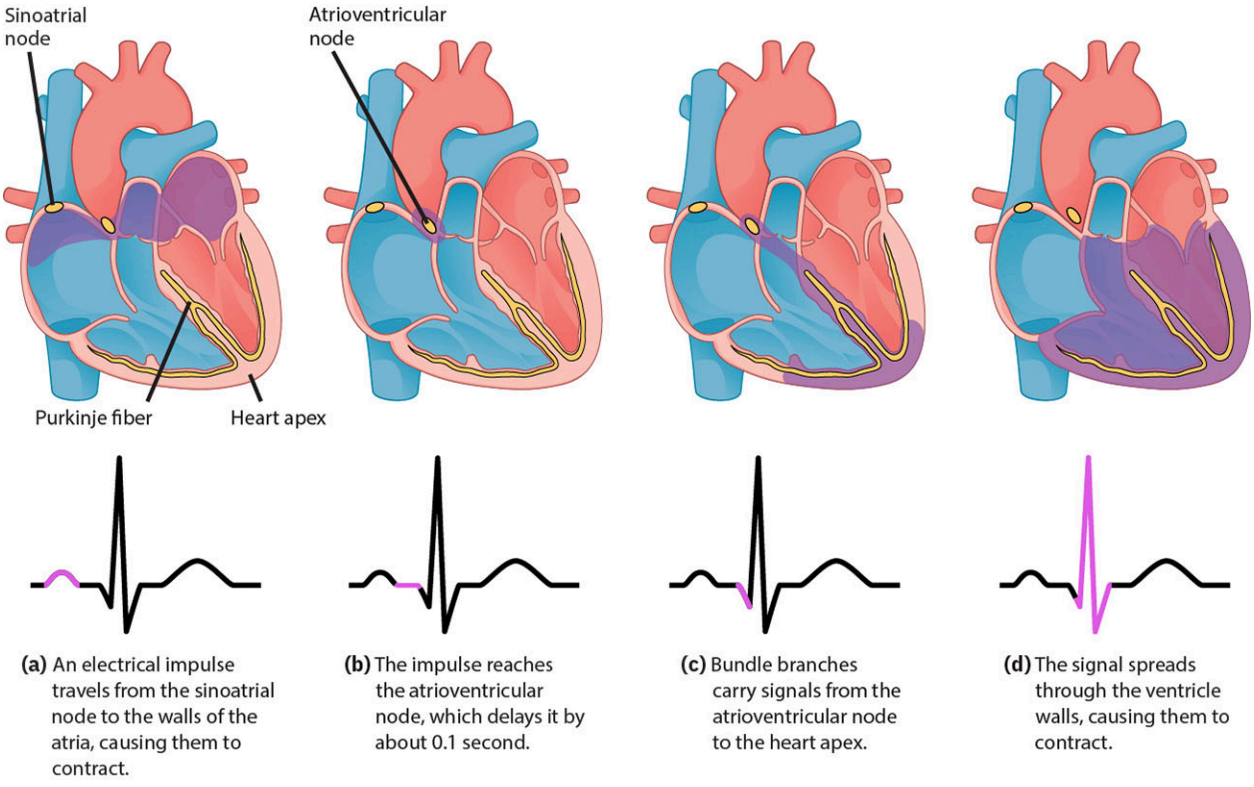


FIGURE 18.20 The beating of the heart is regulated by an electrical impulse that causes the characteristic reading of an ECG. The signal is initiated at the sinoatrial valve. The signal then (a) spreads to the atria, causing them to contract. The signal is (b) delayed at the atrioventricular node before it is passed on to the (c) heart apex. The delay allows the atria to relax before the (d) ventricles contract. The final part of the ECG cycle prepares the heart for the next beat. (credit: modification of work from *Biology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

An ECG is often combined with cardiac biomarker testing when acute symptoms indicative of MI or other cardiac emergencies are present. ECG can also be performed to monitor conditions and treatments or used for routine screening for cardiomyopathy. An ECG machine conventionally has twelve leads, which are labeled with their respective placement on the body (Figure 18.21).

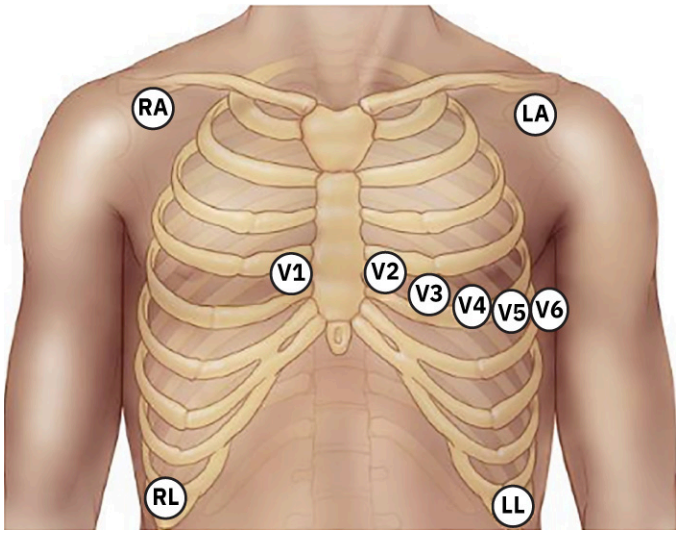


FIGURE 18.21 ECG electrode placement. (credit: modification of work by Jacqueline Christianson/Nurses International, CC BY 4.0)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Performing a Twelve-Lead EKG

See the competency checklist for Performing a Twelve-Lead EKG. You can find the checklists on the Student resources tab of your book page on openstax.org.

Small graph paper (Figure 18.22) is used to record and measure an ECG. The vertical axis shows the electrical signal strength, and the horizontal axis shows the passage of time. Measurements are taken based on the boxes. Each large box is outlined in a darker shade and contains five smaller boxes, both horizontally and vertically. Horizontally, each small box shows the passage of 0.04 seconds, so each large box (four small boxes) indicates 0.2 seconds.

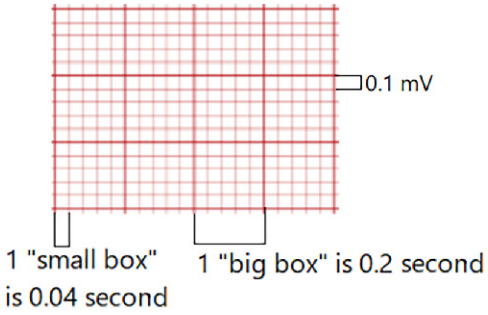


FIGURE 18.22 This example shows typical ECG graph paper. (credit: modification of work by Jacqueline Christianson/Nurses International, CC BY 4.0)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Applying a Holter Monitor

See the competency checklist for Applying a Holter Monitor. You can find the checklists on the Student resources tab of your book page on openstax.org.

On the ECG paper, the firing of the SA node and the electrical signal to the AV node, with atrial contraction, is known as the P wave. Next the AV node receives and holds the signal after the atria contract, while the ventricles fill, called the PR segment. The PR interval is the time from the beginning of the P wave to the start of the Q wave. The QRS complex is the flow of electricity from the AV node through the bundle of His and to the Purkinje fibers—this leads to ventricular contraction. Last is the T wave, when the ventricles repolarize. The QT interval measurement is taken from the beginning of the Q through the end of the T wave. Finally, the ST segment measurement is from the end of the S to the start of the T wave (Figure 18.23) (Christensen et al., 2023).

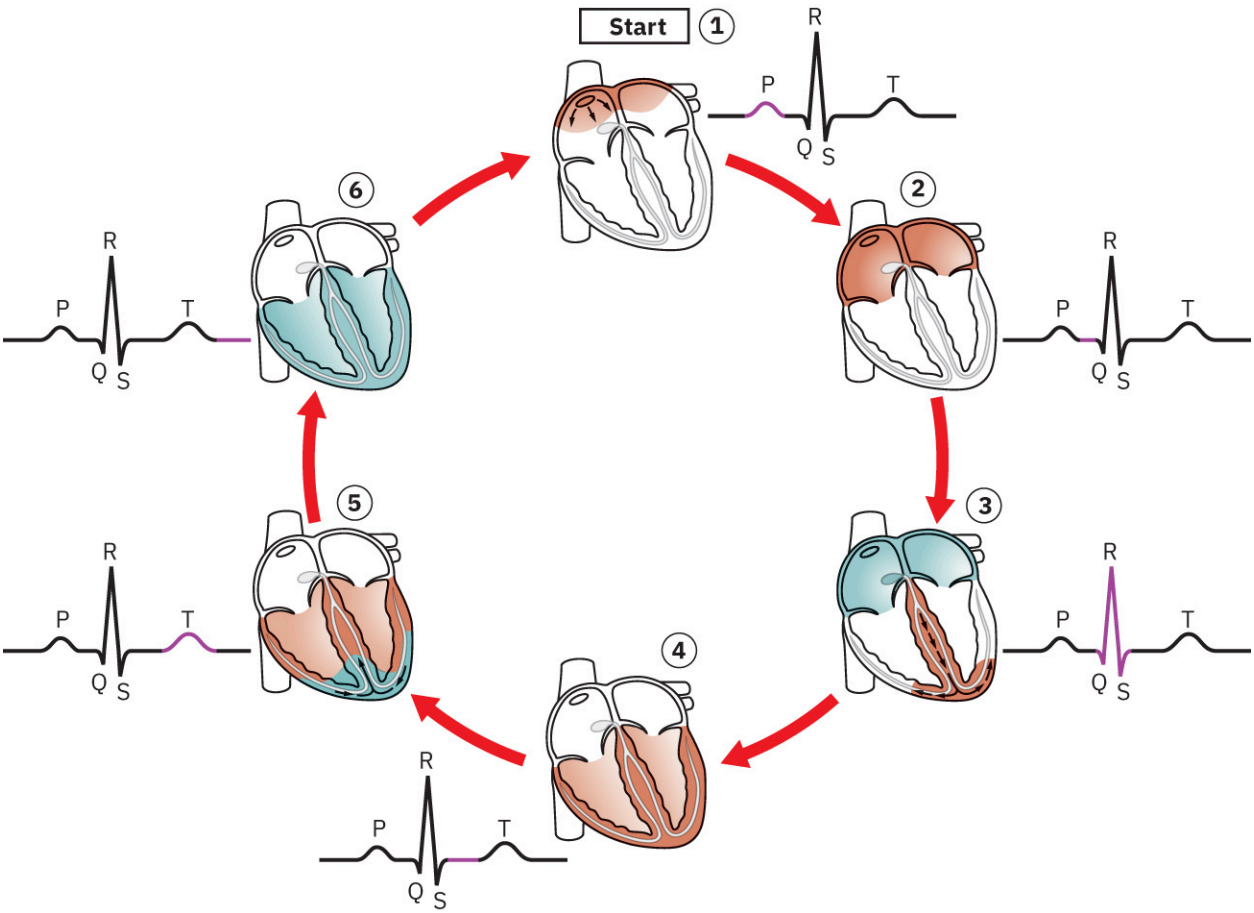


FIGURE 18.23 This diagram correlates an ECG tracing with the electrical and mechanical events of a heart contraction. Each segment of an ECG tracing corresponds to one event in the cardiac cycle. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LINK TO LEARNING

Familiarize yourself with the ECG (https://openstax.org/r/77ECGInfo) by watching this video.

18.4 Management of Impaired Cardiopulmonary Functioning

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe nursing actions for management of impaired cardiopulmonary functioning
- Understand interdisciplinary collaboration for management of impaired cardiopulmonary functioning
- Describe emergency interventions for impaired cardiopulmonary functioning

Nurses are involved in the management of cardiopulmonary care throughout the care plan, from assessment and planning through evaluation and reassessment. Nursing actions while caring for patients with impaired cardiopulmonary function are varied, from routine to emergent care. Patients with cardiovascular and/or pulmonary dysfunctions may be stable or suffering an emergency event, such as a deadly cardiac rhythm or a respiratory or cardiac arrest. Depending on the care setting, nurses have to be able to respond and act to patients' changes in status, with interventions, patient education, and guidance regarding self-monitoring, through drug therapy (routine and emergent), defibrillation, and CPR. Nurses are also part of a healthcare team and as such work with other members from different disciplines. Interdisciplinary care provides a holistic approach to patients and their care and brings about positive outcomes.

Nursing Actions

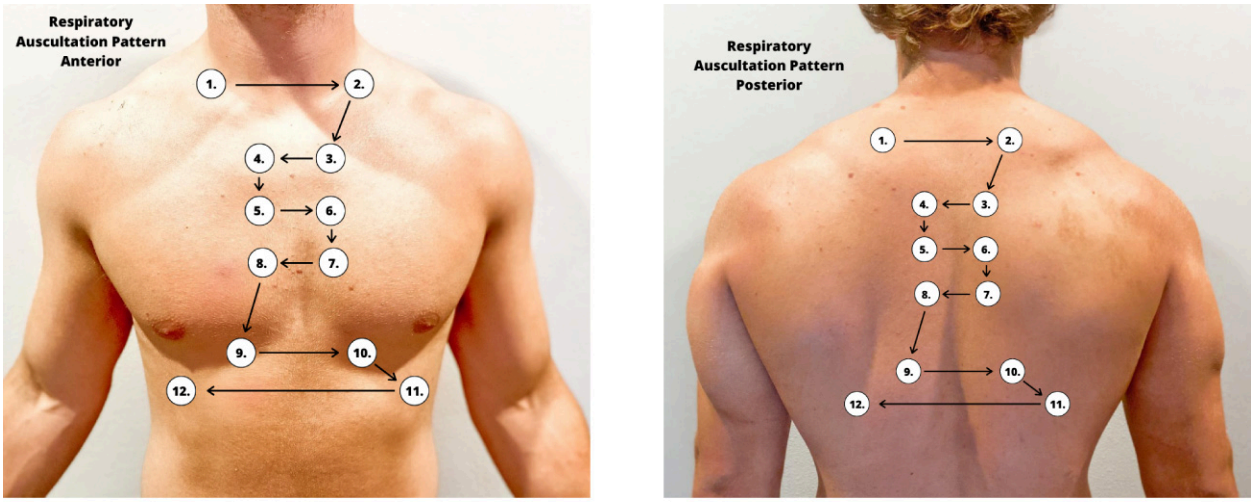
Nurses are directly involved in patient care. From assessment to evaluation, nurses are creating, implementing, and evaluating their care plans based on the current status of their patients. Nursing actions relative to the cardiopulmonary system reflect particular actions designed for the respiratory system and those for the cardiovascular system. Some interventions, like O_2 therapy and behavioral modifications, are apt to benefit both components of the cardiopulmonary system. Even drug therapy in one category is prone to assist with symptoms or deficits in the other, as an improvement in ventilation, oxygenation, or perfusion can be expected to improve the others. In this section, specifics as to assessment, a variety of tools and techniques, medications, and topics for patient education are discussed. Additionally, interdisciplinary collaborative examples are explored as are emergency interventions specific to the respiratory and cardiovascular systems.

Respiratory Assessment

The evaluation of the respiratory system includes collecting subjective and objective data through a detailed interview and physical examination of the thorax and lungs. This examination can offer significant clues related to issues associated with the body's ability to obtain adequate oxygen to perform daily functions. Inadequacy in respiratory function can have significant implications for the overall health of the patient.

Collect subjective data using interview questions, paying particular attention to what the patient is reporting. The interview should include questions regarding any current and past history of respiratory health conditions or illnesses, medications, and reported symptoms. Consider the patient's age, gender, family history, race, culture, environmental factors, and current health practices when gathering subjective data.

A focused respiratory objective assessment includes interpretation of vital signs; inspection of the patient's breathing pattern, skin color, and respiratory status; palpation to identify abnormalities; and auscultation of lung sounds (Figure 18.24) using a stethoscope. The nurse must have an understanding of what is expected given a patient's age, gender, development, race, culture, environmental factors, and current health condition to determine the meaning of the data that are being collected.



(a) (b)

FIGURE 18.24 There is a systematic approach to auscultation of the chest for breath sounds, (a) anterior and (b) posterior. (credit a: modification of work "Anterior Respiratory Auscultation Pattern.png" by Meredith Pomietlo, CC BY 4.0; credit b: modification of work "Posterior Respiratory Auscultation Pattern.png" by Meredith Pomietlo, CC BY 4.0)

LINK TO LEARNING

Visit Lung Sounds Made Easy (https://openstax.org/r/77LungsSounds) to learn more about abnormal lung sounds.

When certain findings indicate further exploration, palpation and percussion may be performed. An example is if on inspection the nurse finds apparent edema around one or both collarbones, especially if the patient was recently

intubated with an ETT. Palpation can be used in such a situation to assess for **subcutaneous emphysema** (air in the subcutaneous tissue), as the tiny air pockets feel crispy (**crepitus**) to the fingertips. Percussion is helpful for the nurse to determine underlying structures in the pulmonary cavity, whether a region that should be air filled instead contains fluid or a solid mass. Refer to Table 18.4 for expected and unexpected assessment results.

Assessment	Expected Findings	Unexpected Findings (Document and Notify Provider if a New Finding*)
Inspection	• Effortless work of breathing • Regular breathing pattern • Respiratory rate within normal range for age • Symmetrical chest expansion • Absence of cyanosis or pallor • Absence of use of accessory muscles, retractions, and/or nasal flaring • Anteroposterior: transverse diameter ratio 1:2	• Labored breathing • Irregular rhythm • Increased or decreased respiratory rate • Accessory muscle use, pursed-lip breathing, nasal flaring (infants), and/or retractions • Presence of cyanosis or pallor • Asymmetrical chest expansion • Clubbing of fingernails
Palpation	• No pain or tenderness with palpation • Skin warm and dry • No crepitus or masses	• Pain or tenderness with palpation • Cool, clammy, or moist skin • Crepitus, palpable masses, or lumps
Percussion	• Clear, low-pitched, hollow sound in normal lung tissue	• Dull sounds heard with high-density areas, such as pneumonia or atelectasis
Auscultation	• Bronchovesicular and vesicular sounds heard over appropriate areas • Absence of adventitious lung sounds	• Diminished lung sounds • Adventitious lung sounds, such as crackles, rales, wheezes, stridor, or pleural rub
*CRITICAL CONDITIONS to report immediately		• Decreased oxygen saturation (<92 percent or as prescribed) • Pain • Worsening dyspnea • Decreased level of consciousness, restlessness, anxiousness, and/or irritability

TABLE 18.4 Expected versus Unexpected Respiratory Assessment Findings

Cardiovascular Assessment

The evaluation of the cardiovascular system includes a thorough medical history and a detailed examination of the heart and peripheral vascular system. Nurses must incorporate subjective statements and objective findings to elicit clues of potential signs of dysfunction. Symptoms like fatigue, indigestion, and leg swelling may be benign or may indicate something more ominous. As a result, nurses must be vigilant when collecting comprehensive information to utilize their best clinical judgment when providing care for the patient.

The subjective assessment of the cardiovascular and peripheral vascular system is vital for uncovering signs of potential dysfunction. To complete the subjective cardiovascular assessment, the nurse begins with a focused interview. The focused interview explores past medical and family history, medications, cardiac risk factors, and

reported symptoms. Symptoms related to the cardiovascular system include chest pain, peripheral edema, unexplained sudden weight gain, shortness of breath (dyspnea), irregular pulse rate or rhythm, dizziness, or poor peripheral circulation. Any new or worsening symptoms should be documented and reported to the healthcare provider.

The physical examination of the cardiovascular system involves the interpretation of vital signs, inspection, palpation, and auscultation of heart sounds. Jugular venous distension may be visible, especially as patients are repositioned. As the nurse is examining the patient, palpation may accompany, as clothing is moved or removed and the patient is touched. Further signs of perfusion can be assessed, like the temperature and moisture of the skin (e.g., warm and dry versus cool and clammy). To complete palpation, capillary refill and peripheral pulses should be assessed. After completing a cardiovascular assessment, it is important for the nurse to use critical thinking to determine whether any findings require follow-up (Table 18.5).

Assessment	Expected Findings	Unexpected Findings (Document and Notify Provider if a New Finding*)
Inspection	Apical impulse may or may not be visible	• Scars not previously documented that could indicate prior cardiac surgery • Heave or lift observed in the precordium • Chest anatomy malformation
Palpation	Apical pulse felt over midclavicular fifth intercostal space	• Apical pulse felt to the left of the midclavicular fifth intercostal space • Additional movements over precordium such as a heave, lift, or thrill
Auscultation	S1 and S2 heart sounds in regular rhythm	• Irregular heart rhythm • Extra heart sounds such as a murmur, S3, or S4
*CRITICAL CONDITIONS to report immediately		• Symptomatic tachycardia at rest (HR >100 bpm) • Symptomatic bradycardia (HR <60 bpm) • Hypotension (systolic BP <100 mm Hg) • Orthostatic BP changes • New abnormal cardiac rhythm • New extra heart sounds such as a murmur, S3, or S4 • Reported chest pain, calf pain, or worsening shortness of breath

TABLE 18.5 Expected versus Unexpected Cardiac Assessment Findings

Auscultation is routinely performed over five specific areas of the heart to listen for corresponding valvular sounds. These auscultation sites are often referred to by the mnemonic “APE To Man,” referring to aortic, pulmonic, Erb point, tricuspid, and mitral areas (Figure 18.25).

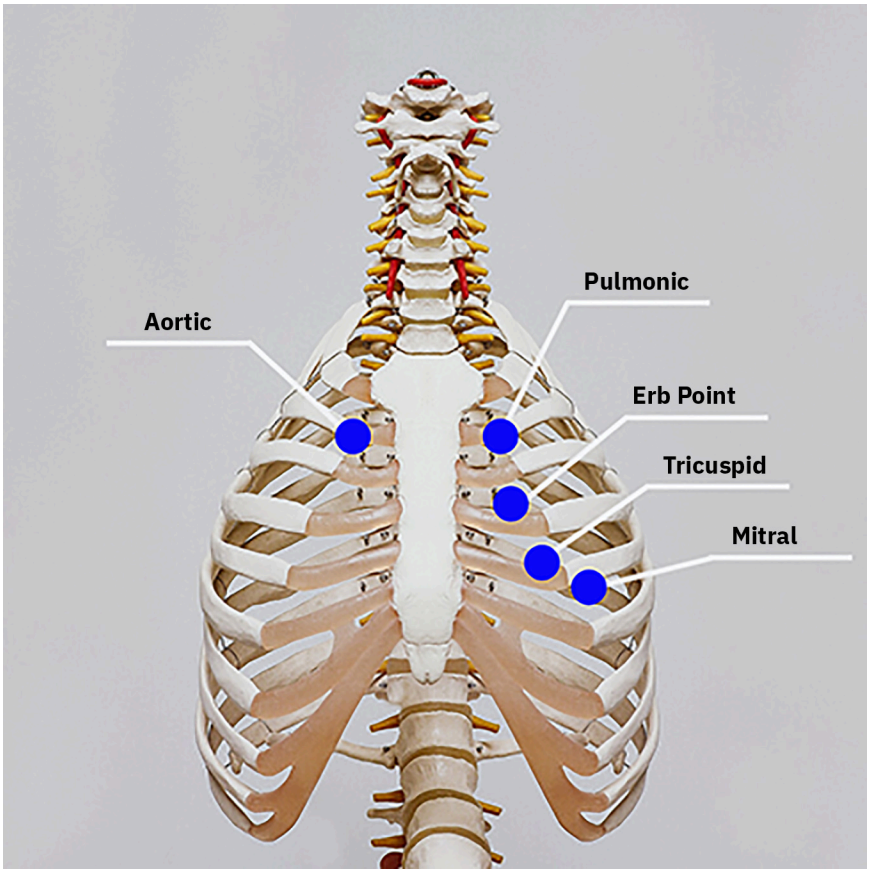


FIGURE 18.25 Locations for heart auscultation. (credit: modification of work "*Cardiac Auscultation Areas*" by Meredith Pomietlo, CC BY 4.0)

Auscultation usually begins at the aortic area (upper right sternal edge). Use the diaphragm of the stethoscope to carefully identify the S1 and S2 sounds. They will make a "lub-dub" sound. Note that when listening over the area of the aortic and pulmonic valves, the "dub" (S2) will sound louder than the "lub" (S2). Move the stethoscope sequentially to the pulmonic area, Erb point, and tricuspid area. Repeat this process with the bell of the stethoscope. The apical pulse should be counted over a sixty-second period. For an adult, the HR should be between 60 and 100 with a regular rhythm to be considered within normal range.

LINK TO LEARNING

A review of blood flow and the heart's sounds (https://openstax.org/r/77BloFlowHeaSou) is provided in this video. Listen for normal and abnormal sounds and what they mean.

The first heart sound (S1) identifies the onset of systole, and the second heart sound (S2) identifies the end of systole and the onset of diastole; when the semilunar valves close, the AV valves open, and the ventricles fill with blood. When auscultating, it is important to identify the S1 ("lub") and S2 ("dub") sounds, evaluate the rate and rhythm of the heart, and listen for any extra heart sounds.

Encourage Breathing Techniques

There are several techniques a nurse can teach a patient to use to enhance their breathing and coughing. These techniques include diaphragmatic breathing, pursed-lip breathing, incentive spirometry, and coughing and deep breathing.

Diaphragmatic Breathing

Diaphragmatic breathing is a technique that is helpful for patients who are tachypneic, whether from a physiological source or anxiety. The technique helps focus attention on breathing and consciously learn to control it. The nurse teaches the patient to intentionally realize whether the chest or the abdomen is the source of breaths. It is often

recommended to advise the patient to place a hand on the chest and one on the abdomen and self-assess the source. This begins the slowing and relaxing process. Once the patient realizes the source of breath is the chest, teaching is aimed at the patient redirecting attention toward breathing from the abdomen (diaphragm). With concentration on the technique, the tachypnea should begin to resolve, and with it, an improvement as the physical response to pH changes from hyperventilation normalizes and/or a sense of relaxation and anxiety reduction takes place. Sometimes the anxiety involved with severe dyspnea, or from a mental health situation, may respond well to anxiolytic drug therapy in addition to diaphragmatic breathing.

Pursed-Lip Breathing

Pursed-lip breathing is a technique that allows people to control their oxygenation and ventilation. The technique requires a person to inspire through the nose and exhale through the mouth at a slow, controlled flow. This type of exhalation gives the person a puckered or pursed appearance. By prolonging the expiratory phase of respiration, a small amount of positive end-expiratory pressure is created in the airways that helps to keep them open so that more air can be exhaled, thus reducing air trapping that occurs in some conditions such as COPD. Pursed-lip breathing often relieves the feeling of shortness of breath, decreases the work of breathing, and improves gas exchange. People also regain a sense of control over their breathing while simultaneously increasing their relaxation.

Incentive Spirometry

An incentive spirometer is a medical device often prescribed after surgery to prevent and treat atelectasis (Figure 18.6). Atelectasis occurs when alveoli become deflated or filled with fluid, and this can lead to pneumonia. While sitting upright, the patient should breathe in slowly and deeply through the tubing with the goal of raising the piston to a specified level. The patient should attempt to hold their breath for five seconds, or as long as tolerated, and then rest for a few seconds. This technique should be repeated by the patient ten times every hour while awake. The nurse may delegate this intervention to unlicensed assistive personnel, but the frequency at which it is completed and the volume achieved should be documented and monitored by the nurse.

Coughing and Deep Breathing

Teaching the coughing and deep breathing technique is similar to incentive spirometry, but no device is required. The patient is encouraged to take deep, slow breaths and then exhale slowly. After each set of breaths, the patient should cough. This technique is repeated three to five times every hour.

REAL RN STORIES

Preventive Pulmonary Toilet

Nurse: Aarti, RN
Clinical setting: ICU
Years in practice: 2
Facility location: San Jose, California

My patient assignment for the night was a male (Mr. Leonard, or Mr. L) who had undergone coronary artery bypass grafting (CABG) earlier in the day. His surgery had gone well, with no major events during or in the first few hours of recovery in the ICU. As we did shift report, and bedside check, hemodynamics were stable, and Mr. L's major issue was pain. I brought a syringe of morphine with me when I did his initial assessment and gave him his first divided dose. By the time I was done with a head-to-toe at 7:30 p.m., he was gently snoring.

The standard for ICU patients was for them to be turned at least every two hours; post-op CABG patients hourly, to keep pulmonary secretions mobile, and the chest tubes draining. The IS orders were for "ten times while awake," but Mr. L had refused the previous hour with the day shift nurse, and now he was asleep. I let him rest at 7:30 p.m., and since he was still sleeping at 8 p.m., didn't wake him. His VS continued to be fine, and while I turned him at 9 p.m., I didn't insist he do his ten reps of the IS. When I checked his VS at 10 p.m., all was stable except his temperature of 100.6°F (38°C); I medicated his 8-of-10 pain and went to the nurses' station to review the flowchart and chart—his temperature had been 97.8°F (36.6°C) at 7:30 p.m. One of my colleagues asked how Mr. L was doing, and I told her about the low-grade fever. Her first question was, "How has he been doing on his IS?" Surprised, I

admitted that I hadn't had him do it, as I was focused on his pain control and rest. But her question clicked that subject open in my mind, and I began consistent pulmonary toilet—while he was not happy to be kept awake, he did the breathing exercises as I requested. An hour later, I medicated his pain, and a few minutes later insisted on the IS again.

At midnight, I checked his temperature again, fully expecting it to have climbed further, but it was 98.9°F (37.2°C). At that moment, early in my practice, I became fully convinced of the power of aggressive pulmonary toilet and the ability of deep breathing to reduce and prevent atelectasis. Mr. L and I continued with his hourly IS throughout the early morning hours, and his temp was 98.3°F (36.8°C) at 4 a.m. As I drove home and reflected on the events of the shift, I thought about how easy it is for a patient to develop atelectasis, and the importance of early prevention through deep breathing and coughing. The other realization for me was how easy it probably would have been for me to prevent it entirely by starting the IS with my first shift assessment. However, by having had this experience (and happily with Mr. L's quick recovery from all aspects of his surgery, without development of post-op pneumonia!), my patient education on the rationale for use of the IS from that night forward became much more compelling.

Frequent Repositioning

Repositioning a patient with impaired cardiopulmonary status maintains body alignment, prevents pressure injuries from low perfusion and hypoxia, and prevents foot drop and contractures. When repositioning a patient in bed, supportive devices such as pillows, rolls, and blankets can aid in providing comfort and safety. It is important to reposition patients appropriately to prevent neurological injury that can occur if a patient is inadvertently placed on their arm. Frequent repositioning also allows for respiratory secretions to mobilize rather than pool in one location (usually dependent, based on gravity). Being turned may cause deeper breaths and may inspire coughing. Position changes also enhance comfort, which reduces pain, allowing for ease of breathing and again more likelihood of full and effective breaths.

Medication Administration

There are medications recognized as specific to the respiratory system and those associated with the cardiovascular system; some have effects on both components of the cardiopulmonary system. Medication administration for respiratory and cardiac drugs involves nurses being familiar with a variety of administration routes. Respiratory drugs may be given as nasal sprays and drops, inhalers, tablets, or capsules to be administered orally or through injections by intramuscular (IM), subcutaneous (SC), or intravenous (IV) access. Cardiac medications add the potential for topical (e.g., nitroglycerin ordered by patch or cream) application and do not include the wide variety through sprays, drops, or powders. When immediate actions are desired, drugs for cardiopulmonary emergencies are typically administered by IV or intraosseous (IO) routes, though respiratory emergencies may still require inhaled doses of certain drugs.

Respiratory Medications

There are various drug classes to treat respiratory pathophysiological problems—all with a goal relative to improving function, whether through improved oxygenation or ventilation (Table 18.6).

Type	Drug	Mechanism of Action
Sympathetic nervous system: Beta$_2$ adrenergic agonists	Albuterol (Proventil HFA)	Capitalizes on the bronchodilation response of SNS stimulation
Parasympathetic nervous system: anticholinergics	Tiotropium (Spiriva—long acting), ipratropium (Atrovent—short acting)	Blocks the bronchoconstriction response of muscarinic PSNS stimulation

TABLE 18.6 Commonly Used Respiratory Medications

Type	Drug	Mechanism of Action
Methylxanthine derivatives	Theophylline (Theo-24)	Smooth muscle relaxation allowing bronchodilation
Corticosteroids	Triamcinolone Nasocort Allergy—nasal; Aristospan—systemic)	Prevention of reaction or worsening reaction to inflammation, whether local or systemic depends on drug, dose, and route
Leukotriene receptor antagonists	Montelukast (Singulair)	Blockade of leukotriene receptors and related decreased inflammatory responses
Cromolyn	NasalCrom	Blocks mast cells and related inflammatory actions
Antihistamines	Diphenhydramine (Benadryl), loratadine (Claritin)	Blocks action of histamine; first generation has broader effects, including sedation
Decongestants	Pseudoephedrine (Sudafed)	Adrenergic stimulation releases norepinephrine, causing vasoconstriction
Expectorants	Guaifenesin (Mucinex)	Causes vagal response that increases fluid in the respiratory tract; thins mucous
Antitussives	Dextromethorphan (Robitussin)	Depression of cough center (medulla) and cough receptors in respiratory tract
Anti-infectives	Numerous classes of anti-infectives—selection based on type of infection (C&S results)	Cause injury or death to infectious microbial cells

TABLE 18.6 Commonly Used Respiratory Medications

Cardiac Medications

As varied as the potential diagnoses that affect the cardiovascular system are the drugs to treat the disorders. Medications are used to modify actions of the ANS in order to lower or raise BP; they treat dyslipidemias and often-linked CAD; antianginal drugs relieve chest pain; there are drugs to treat HF, medications to help the kidneys remove excess fluid; there are those that may treat or prevent dysrhythmias, and there are drugs to prevent and/or treat clotting problems (Table 18.7).

Type	Drug	Mechanism of Action
ACE inhibitors	Lisinopril, enalapril	Vasodilation from inhibition of angiotensin-converting enzyme, and therefore prevention of angiotensin I conversion to angiotensin II (vasoconstrictor); decreases cardiac remodeling and overt HF (some patients)
Angiotensin receptor blockers (ARBs)	Valsartan (Diovan)	Blocks angiotensin II effects of aldosterone release and vasoconstriction at the angiotensin receptors

TABLE 18.7 Commonly Used Cardiac Medications

Type	Drug	Mechanism of Action
Antianginals	Nitroglycerin	Arterial and venous vasodilation increases perfusion and decreases O_2 demand
Anti-arrhythmic	Adenosine (Adenocard)	Temporarily slows or arrests AV conduction and return to NSR
Antianginals	Nitroglycerin	Arterial and venous vasodilation increases perfusion and decreases O_2 demand
Beta blockers	Atenolol, sotalol	Inhibits stimulation of beta receptors; prolongs cardiac cycle refractory period
Calcium channel blockers	Diltiazem (Cardizem)	Smooth muscle relaxation allows for vasodilation; decreases cardiac workload inhibition of calcium during depolarization
Cardiac glycosides	Digoxin (Lanoxin)	Improves cardiac contractility by three mechanisms: positive inotrope (increases contractility, SV, and CO), negative dromotrope (decreased cardiac conduction), and negative chronotrope (lowers HR)
Catecholamines	Norepinephrine	SNS stimulation causes vasoconstriction for enhanced organ perfusion
Diuretics (loop)	Furosemide	Inhibits reabsorption of sodium in the loop of Henle and distal tubule; increases urine and electrolyte output
Diuretics (potassium sparing)	Spironolactone (Aldactone)	Aldosterone antagonist—inhibits sodium reabsorption without loss of potassium
Diuretics (thiazide)	Hydrochlorothiazide (Microzide)	Inhibits reabsorption of sodium in the distal tubule—increases urine output
HMG CoA reductase inhibitors (a.k.a. “statins”)	Rosuvastatin (Crestor)	Inhibits production of cholesterol by inhibiting HMG CoA reductase; LDL is decreased
Neprilysin inhibitor and ARB combination	Sacubitril/valsartan (Entresto)	Inhibits neprilysin (enzyme), allowing for increased natriuretic peptides, which causes vasodilation and sodium (and water) excretion; valsartan (see ARBs)

TABLE 18.7 Commonly Used Cardiac Medications

Type	Drug	Mechanism of Action
Potassium channel blockers	Amiodarone (Pacerone)	Prolongs repolarization through blockade of potassium channels
Sodium channel blockers	Lidocaine	Decreases influx of sodium to cardiac cells—depolarization is prolonged

TABLE 18.7 Commonly Used Cardiac Medications

Oxygen Therapy

O_2 is considered a drug and requires a prescription or healthcare provider's order for nurses to administer it. When administering oxygen to a patient, it is important to ensure that oxygen flow rates are appropriately set according to the type of administration device (Table 18.8). When administering oxygen therapy, it is important for the nurse to assess the patient before, during, and after the procedure and document the findings.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Administering Oxygen

See the competency checklist for Administering Oxygen. You can find the checklists on the Student resources tab of your book page on openstax.org.

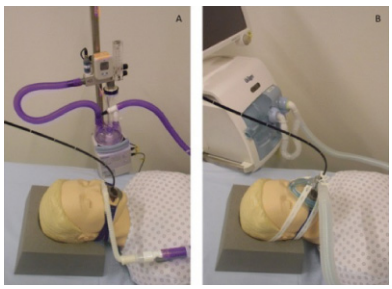
Device	Flow Rates and Oxygen Percentage	Image
Nasal cannula	Flow rate: 1 to 6 L/min FiO_2: 24 to 44 percent	 (credit: "Nasal Cannula" by National Library of Medicine/ National Center for Biotechnology Information, CC BY 4.0)
High-flow nasal cannula	Flow rate: up to 60 L/min FiO_2: up to 100 percent	 (credit: "Illustration of bronchoscopy using HFNC (A) or NIV (B)" by National Library of Medicine, CC BY 4.0)

TABLE 18.8 Settings of Oxygenation Devices

Device	Flow Rates and Oxygen Percentage	Image
Simple mask	Flow rate: 6 to 10 L/min FiO_2: 28 to 50 percent	 (credit: “Simple Face Mask” by Glynda Rees Doyle and Jodie Anita McCutcheon, CC BY 4.0)
Non-rebreather mask	Flow rate: 10 to 15 L/min FiO_2: 60 to 80 percent Safety Note: The reservoir bag should always be partially inflated.	 (credit: “Non re-breather mask” by Glynda Rees Doyle and Jodie Anita McCutcheon, CC BY 4.0)

TABLE 18.8 Settings of Oxygenation Devices

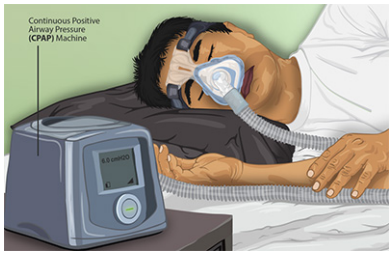
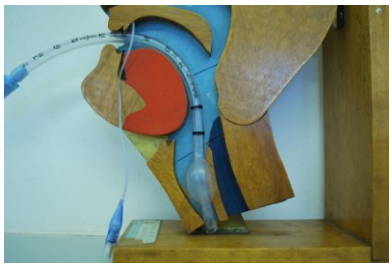
Device	Flow Rates and Oxygen Percentage	Image
CPAP, bilevel positive airway pressure (BiPAP), Venturi mask, mechanical ventilator	Use the settings provided by the respiratory therapist and/or provider order.	CPAP:  (credit: "Depiction of a Sleep Apnea patient using a CPAP machine" by "myUpchar"/Wikimedia Commons, CC BY 4.0) Endotracheal tube (ETT):  (credit: "Endotracheal tube" by John Campbell/Flickr, Public Domain) Mechanical ventilator: (credit: "Simulated Intubated Patient on a Mechanical Ventilator" by National Center for Biotechnology Information/National Library of Medicine/National Institutes of Health, CC BY 4.0)
Bag valve mask	Flow rate: 15 L/min FiO_2: 100 percent Squeeze the bag once every five to six seconds for an adult or once every three seconds for an infant or child.	 (credit: "Bag Valve Mask New" by "JonnyEMSJD"/Wikimedia Commons, Public Domain)

TABLE 18.8 Settings of Oxygenation Devices

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 8

Refer back to Unfolding Case Study #3: Part 7 to review the patient data.

Provider's Orders	**1940:** Supplemental oxygen to maintain oxygen saturation greater than 92 percent Insert peripheral IV Furosemide 20 mg IV × one dose Monitor and document accurate intake and output

3. Prioritize hypotheses: Based on the information presented in the case study, what do you think is the most likely cause of the patient's symptoms?
4. Generate solutions: What is the rationale for each of the provider's orders?
5. Take action: What is the priority action by the nurse at this time?
6. Evaluate outcomes: After implementing the provider's orders, what assessment findings would indicate that the interventions were successful?

Patient Education

It is important to modify patient education methods depending on the individual's knowledge, skills, and abilities. For example, some older adults readily engage in using electronic technology, but others have low digital literacy or experience difficulty when accessing electronic health resources. Nurses should adapt patient education to the needs of the individual and provide verbal, written, or electronic resources, as needed, while considering any sensory, cognitive, or functional impairments. The ultimate goal of health promotion and patient education is to improve their understanding, motivation, and engagement in self-management and promote their quality of life.

Behavioral Modifications

Knowing there are many behaviors that can negatively impact the cardiopulmonary system, it can be important for nurses to provide patient education about behavioral modifications. As part of the nursing history and physical, behaviors like smoking, exercise, nutrition, alcohol, and other intake of drugs, should all be discussed with the patient.

Helping the patient realize how certain applicable behaviors affected overall health, and cardiopulmonary health in particular, is important and can provide the necessary first step in recognition of the action-reaction relationship. Nurses are often the first providers of such information, as so much time is spent directly with patients, and relationships are established whereby patients feel comfortable asking questions. Once identified and recognized, the nurse can begin to introduce applicable information to help modify any negative behaviors.

There is a lot of information available regarding smoking cessation and many resources to help patients quit. Dietary recommendations can be provided, including cardiac diets, and recommendations for calorie intake in the presence of COPD. Patients may need guidance and contacts for support groups in order to consider quitting alcohol or illicit drug use. If expert information is needed, such as specific dietary limitations, the nurse can discuss with the prescribing healthcare provider about a consult with a specialist, in this case, a nutritionist or dietitian.

Pollutants

As patients are seen in outpatient settings or are preparing for discharge from acute inpatient care, exploration by the nurse should include environmental exposures the patient is prone to. Whether this is secondhand smoke, exposure to motor vehicle exhaust, coal dust, or smoke from fires of any variety, patients may not understand the importance of exposure prevention. Patients should know about warnings for poor air quality and actions to take to avoid exposure. Education about appropriate respiratory protection devices, when to don and doff them, and how to wear them correctly can be discussed. And for information beyond the scope of nursing practice, the nurse can teach patients how to find reliable resources.

Coping Techniques to Reduce Anxiety

Coping strategies are behaviors used to manage anxiety. Effective strategies control anxiety and lead to problem-solving, but ineffective strategies can lead to use, misuse, or overuse of food, tobacco, alcohol, or drugs. Nurses teach and reinforce effective coping strategies.

The nurse should determine what techniques the patient has used historically, and together the nurse and patient can discuss which have been successful and which have not. This can lead to behavior modifications and introduce new and healthy recommendations for coping in stressful situations. Often techniques like slow, deep breaths can be helpful. Some patients respond well to distraction and imagining a pleasant place or recalling a fond memory. The nurse can also suggest to the patient and prescriber the possibility of pharmacological intervention for anxiety to be added or adjusted to the patient's care plan.

Comfort Measures

Establishing and maintaining comfort can be vital to patients while they are battling illness, painful symptoms, and fear. Nurses should be aware that some physical problems cause pain or discomfort, and many diagnostic tests and interventions inflict pain upon patients, who may already be uncomfortable.

The nurse should remain mindful of not only the treatments and pharmacological interventions that will enhance those direct cardiopulmonary physical needs but also the addition of pain medications, anxiolytics, and hypnotics if and when needed. Sometimes the most basic of interventions can better meet a patient's most basic needs: a warm bath, preferred music, or a visit from a pet may help reduce stress, enhance comfort, and assist with rest and healing.

Interdisciplinary Collaboration

Many patients with serious, life-limiting illnesses have common symptoms that the nurse can assess, prevent, and manage to optimize their quality of life. Good symptom management improves quality of life and functioning in all states of chronic illness. Nurses play a critical role in recognizing these symptoms and communicating them to the interdisciplinary team for optimal management.

Collaborating with physical, occupational, speech therapists, and nutrition specialists in the design and implementation of care planning truly enhances patient care and improves patient outcomes (Figure 18.26). The importance of establishing and fostering good relationships with all members of the interdisciplinary team is crucial to safe patient care. Important departments that ensure cardiovascular and pulmonary health are nutrition, cardiac rehabilitation, and chest physiotherapy.

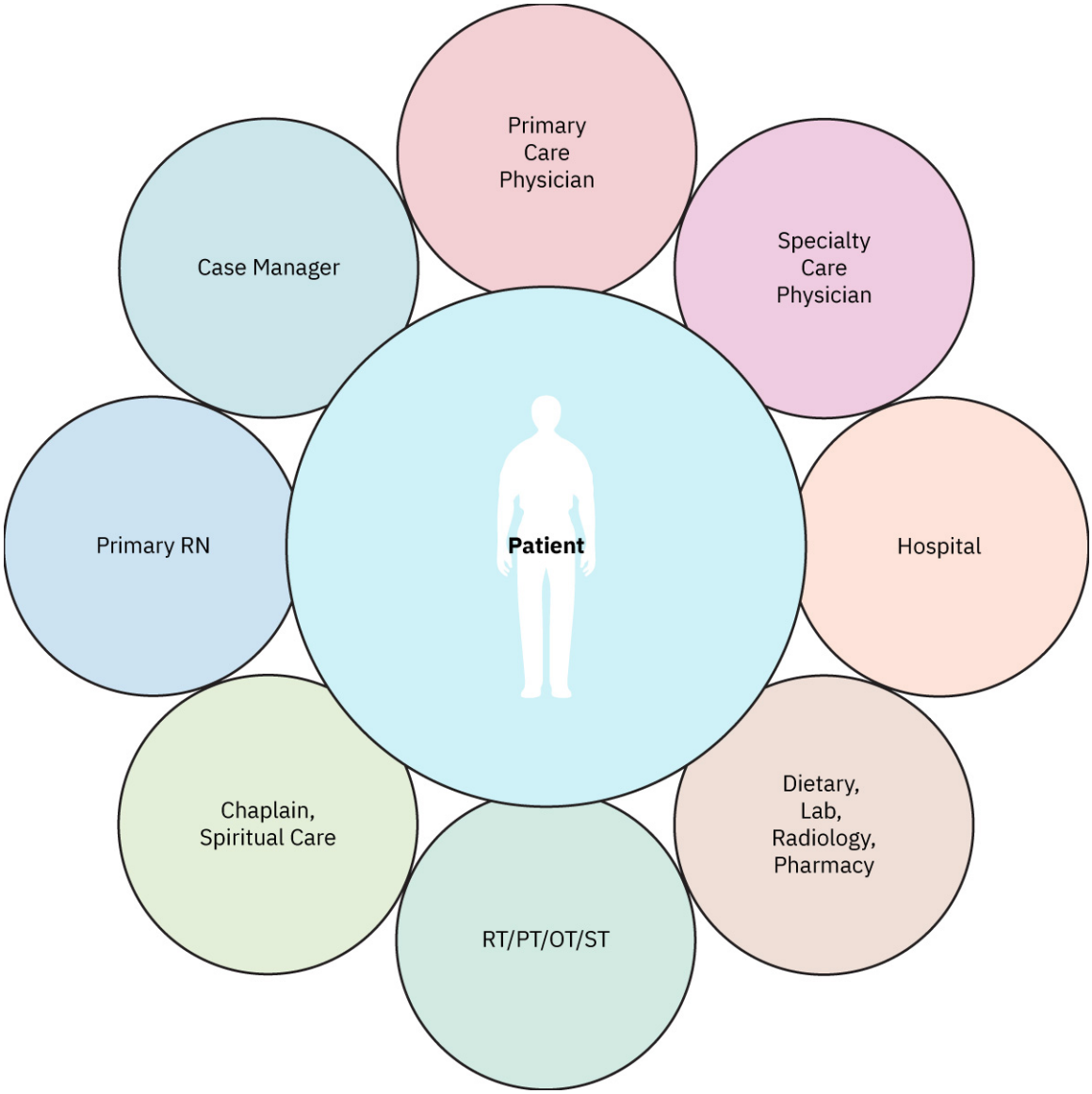


FIGURE 18.26 These are examples of the members of an interdisciplinary care team. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Nutrition

Healthy nutrition helps to prevent obesity and chronic diseases, such as cardiovascular disease. By proactively encouraging healthy eating habits, nurses provide the tools for patients to maintain their health, knowing it is easier to stay healthy than to become healthy after disease sets in. When patients are recovering from illness or surgery, nurses use strategies to promote good nutrition even when a patient has a poor appetite or nausea. If a patient develops chronic disease, the nurse provides education about prescribed diets that can help manage the disease, such as a low-fat, low-salt, low-cholesterol diet for patients with cardiovascular disease.

Patients often need guidance from dietitians to understand, plan for, and follow their specific nutritional needs. Also, whether the patient is actively involved in dietary choices or limitations while hospitalized, the dietitian is involved in the preparation of menu items that meet the needs of all specific diets.

Similar to being aware of a patient's needs in regard to prescribed medications, it is important for nurses to understand patients' dietary requirements and restrictions. Awareness of a cardiac diet, for example, which has limitations relative to sodium and fats, helps nurses provide the correct diets as well as guide patients and families to understand choices and follow recommendations. Patients with significant respiratory illness, like late-stage emphysema, often have increased calorie needs and require supplements with meals to provide enough energy for the extra physiological needs. For those who have comorbidities like DM or renal disease, dietary restrictions and

recommendations are added to their care plans, while in the hospital and on discharge. Nurses tend to be the providers of discharge education, so the ability to describe various diets and caloric needs is important.

Cardiac Rehabilitation

Patients who have substantial cardiac dysfunction, whether having had an MI, or from progressive deterioration like HF, or who are postoperative after surgery for valvular disorder or CABG, are usually prescribed cardiac rehabilitation. Depending on the length of hospitalization, the patient may be quite deconditioned, with anticipated needs for a variety of interdisciplinary therapies in order to gain some strength back and be well enough to return home. Others may not have had significant damage requiring complicated rehabilitation and various therapies. Such rehabilitation may or may not involve time as an inpatient at a dedicated rehabilitation unit or facility.

Many are able to begin their cardiac rehabilitation while inpatient and be taught exercises and activities to be done after discharge. Like physical therapy (which may also be ordered), many rehabilitation actions can be carried out at home by the patient and perhaps with assistance from a family member or friend. Often, there are outpatient visits for some time after discharge, to a cardiac rehabilitation agency, in order to check in, be evaluated, and adjust activities as indicated by patient status and tolerance.

Chest Physiotherapy

There are devices and techniques that can assist patients with maintaining pulmonary function and recuperating from illness or exacerbation of an illness. Previously introduced was the IS, which many patients receive shortly after admission, whether for a long stay in the hospital or merely an overnight stay. These devices are disposable so patients are encouraged to take the IS upon transfer or discharge and continue using it several times daily.

Other methods of chest or respiratory physiotherapy include valves like a flutter valve which use vibration or oscillation to assist with positive expiratory pressure and enhance airway clearance. There are also specialized vests that inflate and deflate and offer vibration and percussion. Percussion can also be done manually by using cupped hands and repeated dull strikes to the chest and back, or with manufactured devices that provide similar thumping to the chest and back.

LINK TO LEARNING

This video presents a demonstration of manual chest physical therapy (https://openstax.org/r/77ManualChestPT) by a respiratory therapist.

The goal of these interventions is to loosen and mobilize secretions from smaller to central airways to enable their removal by coughing or **postural drainage** (positioning the patient to use gravity to allow secretions to drain) (Figure 18.27).

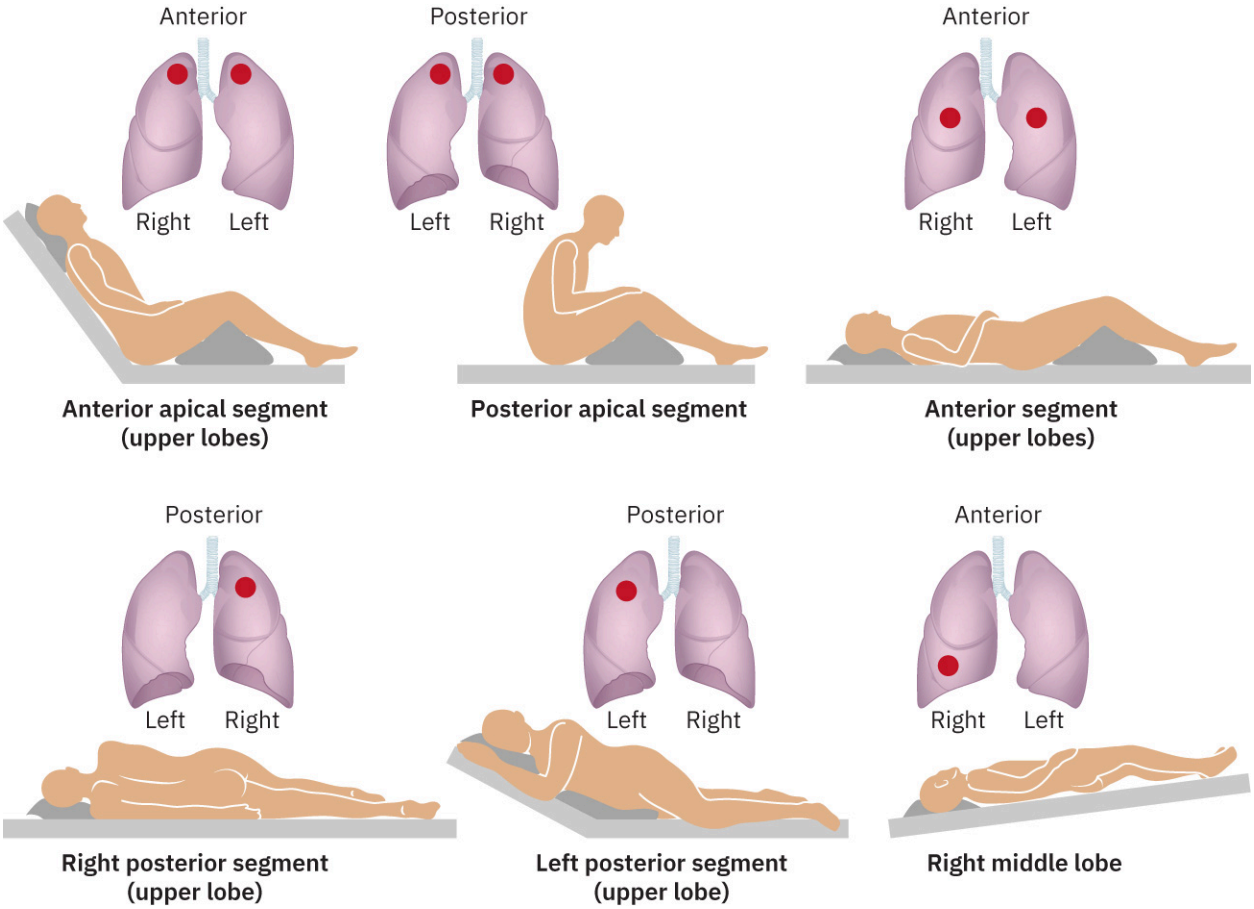


FIGURE 18.27 Postural drainage fosters drainage and removal of secretions from various locations in the lungs. (credit: reproduced by permission of Jane Whitney)

Emergency Interventions

When things go wrong with the cardiopulmonary system, the results can quickly be devastating or fatal. Of course, not all abnormalities are lethal, but an ability to recognize normal and therefore be able to identify abnormal (whether being able to define exactly what is wrong or not) is critical for nurses. It is also important to be vigilant about assessments and know what changes in a patient's status are worthy of immediate follow-up. A few of the things that require urgent or emergent interventions follow in the next and final section of this chapter.

Chest Tube Insertion

Depending on the reason for the insertion of a chest tube, it may be urgent or emergent; it is not typically a routine intervention. Emergent chest tube insertion is perhaps most commonly done for a pneumothorax; hemothorax (or the mixture of hemopneumothorax) and chylothorax are also possibilities that necessitate a chest tube. The lungs have a limited amount of space within the thoracic cage, so situations that alter the area for lungs to inflate and deflate, and those that change the normal pressure, are problematic.

The location for chest tube placement is based on radiography, as pneumothoraces are visible on chest x-rays (Figure 18.28). The nursing role includes reassuring and frequently assessing the patient, providing medication for pain and anxiety, and assisting the physician (or advanced practitioner) with the procedure, including the setup of the chest tube system. The insertion is done under sterile technique, either at the bedside or in an operating room. The flexible tubing from the chest tube system needs to be attached to the chest tube itself, so the nurse holds the clean tubing and the provider who inserted the tube inserts the tube end into the system's tubing.

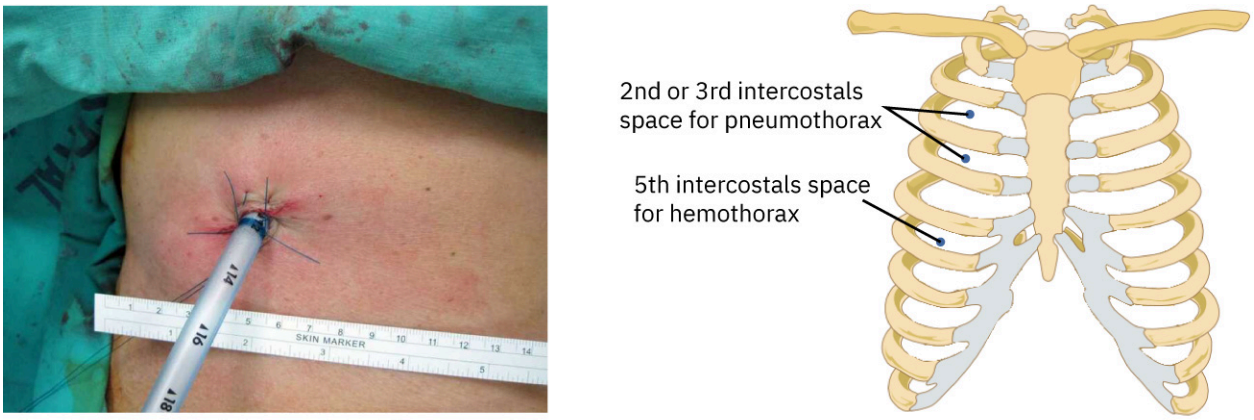


FIGURE 18.28 Chest drainage tubes are placed (a) higher to drain air and (b) lower to drain fluid. (credit a: modification of work "An inserted chest tube" by C. H. Chen, S. Y. Lee et al/Wikimedia Commons, CC BY 2.5; credit b: modification of work "Rib cage" by Mikael Häggström, Public Domain)

A related emergency that requires the insertion of a chest tube for ongoing management is a tension pneumothorax. This develops suddenly and impacts the lung or lungs, heart, and blood vessels. Without immediate intervention, it can be quickly life threatening. Since time is limited before the provider takes the time for chest tube insertion, a large gauge needle is inserted in the second intercostal space and midclavicular line to allow air to escape and the lung to reinflate.

LINK TO LEARNING

The video Chest Tubes—Nursing Management and Assessment Made Easy (https://openstax.org/r/77ChestTubes) presents more information about chest tubes.

Cardiopulmonary Resuscitation

According to the AHA (2023), high-quality CPR is the principal contributor to post–cardiac arrest survival. Nursing students, as well as nurses at all levels—from licensed practical nurses through advanced practice nurses, are normally certified as BLS providers and recertify every two years. Depending on the cause of the arrest, and the subsequent status of the patient, interventions include rescue breathing, chest compressions, and use of an automated external defibrillator (AED) or manual defibrillator. Not all actions are indicated for all patients. For example, a patient who has suffered a respiratory arrest but has a pulse does not need chest compressions, and asystole is not a shockable rhythm. If the patient is pulseless, CPR is indicated, in order to perfuse the body, particularly the brain.

LINK TO LEARNING

The animation CPR in Action (https://openstax.org/r/77CPRinAction) shows the perfusion capabilities of high-quality CPR. It also illustrates what happens when CPR is not done adequately.

Defibrillation

Based on the term itself, defibrillation is the delivery of an electric shock to stop fibrillation (ineffective quivering movement of the heart muscle). Fibrillation, though, can occur in the atria or the ventricles, and atrial fibrillation (A-fib) is not typified as a "deadly rhythm." If an electrical intervention is sought for the treatment of A-fib, it involves fewer joules of electricity and is termed **cardioversion**. Ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT) are nonperfusing rhythms, and defibrillation is indicated emergently. Usually, this is delivered as part of BLS or ACLS efforts and accompanies CPR.

In acute care settings, a cart for arrest situations, also called a code, or COR-0, is present on most or all patient care units. The cart contains a hard backboard to place under the patient to enhance the quality of chest compressions,

airway devices and bag-valve masks of various sizes, emergency drugs, and a manual defibrillator/monitor. In many other settings, automated external defibrillators (AEDs) are available and can be used by laypersons, as the device offers step-by-step instructions. Those who are BLS certified have practiced with AEDs. Defibrillation delivers 150 to 300 joules (depending on the type of device), in an effort to essentially reset (depolarize) the heart and resume a more normal rhythm. Refer to the AHA's guidelines and algorithms (linked in the previous heading) for defibrillator (shock) indications and timing.

LINK TO LEARNING

A demonstration of defibrillation with an AED (https://openstax.org/r/77AEDDefibrilla) is presented in this video. Watch the rhythm examples, as they are from an actual patient. Also, the AHA guidelines and algorithms (https://openstax.org/r/77AHAGuideAlgor) may be reviewed.

Intubation

When a patient is receiving general anesthesia prior to a procedure or surgery or is experiencing respiratory failure or respiratory arrest, an ETT is inserted by an advanced practitioner, such as a respiratory therapist, paramedic, or anesthesiologist, to maintain a secure airway. The ET tube is sealed within the trachea with an inflatable cuff, and oxygen is supplied via a bag valve mask or via mechanical ventilation.

Placement is verified with a CO_2 detection device to ensure it is in the airway and not the esophagus. Auscultation should be done to verify equal, bilateral breath sounds. A chest x-ray will be ordered and performed for definitive placement confirmation and also to verify the ETT is in the optimal position. The ETT is attached to an Ambu bag, and the patient's ventilation is provided by squeezing the bag every six seconds to deliver breaths until a mechanical ventilator is available. At that point, the bag is disconnected from the ETT, and the mechanical ventilator circuit is attached. Nurses collaborate with RTs and healthcare providers regarding the overall care of the patient on a mechanical ventilator.

LINK TO LEARNING

This video shows intubation, bagging, placement detection, and attachment of the ETT to a ventilator (https://openstax.org/r/77ETTVentilator) in an emergency. Watch the technique and landmarks used with the laryngoscope, how the ETT is passed through the vocal cords, and the postintubation actions.

Mechanical Ventilation

A mechanical ventilator is a machine attached to an ETT to assist or replace spontaneous breathing. Mechanical ventilation is termed invasive because it requires the placement of a device inside the trachea through the mouth, such as an ETT. Mechanical ventilators are managed by RTs via protocol or provider order. The FiO_2 can be set from 21 to 100 percent.

Intubation and mechanical ventilation are uncomfortable and distressing to the patient, so patients are customarily sedated with an anxiolytic (e.g., lorazepam or midazolam) or anesthetic-type (e.g., propofol) medication. These drugs help the patient achieve synchrony with the ventilator, allowing the ventilator to provide all, or most of, the ventilation support. Some ventilator settings are so contrary to normal physiological breathing that patients will require continuous IV neuromuscular blockade or chemical paralysis. This drug therapy allows for complete control of breathing by the ventilator, and it is vital to provide sedation for patients on paralytics. Intubated and ventilated patients are at increased risk for ventilator-associated pneumonia (VAP), and there are nursing care actions like maintaining patients with the head of the bed at 30 degrees minimum, frequent oral care, and proton-pump inhibitor therapy in order to prevent the occurrence of VAP.

Summary

18.1 Respiratory System

The various structures of the respiratory system, from the upper to lower airway, into the lungs, and to the capillary-alveolar bed, have been identified and explored. At the capillary-alveolar bed, the primary function of the respiratory system is gas exchange. The functions of these structures have been categorized, relating specific components to the purpose relative to ventilation and perfusion. This section has delved into the physiology of the respiratory system, and how it fits in the cardiopulmonary system. Specifics as to the role this system plays in ventilation, how respiration and gas exchange transpire, and the role the lungs play in the renin-angiotensin-aldosterone system are presented. Respiration is a basic function, generated by the neurological system, with control centers within the medulla oblongata and pons. Regulation by these systems, including actions stimulating the length and depth of each breath, is controlled by opposing actions of the apneustic and pneumotaxic centers, in efforts to maintain homeostasis throughout the body.

18.2 Cardiovascular System

The cardiovascular system is structurally unique insofar as it contains the muscular four-chambered heart (the pump), fluid/blood volume (the tank), and the blood vessels (the pipes). It is an electrical system. Electrical impulses precede the muscular movement or contraction of the heart. When the signals and responses are normal, it functions impeccably. These structures and processes have been explored and analyzed in an effort to understand cardiovascular system physiology.

In the process of investigating the normal anatomy and physiology of the cardiovascular system, regulation of this complex and intertwined system has been reviewed as well. Because normal cardiovascular function is critical to the maintenance of homeostasis, and in anticipation of the next module exploring various aspects of impaired function, this section introduced several cardiovascular dysfunctions and disorders, some of which intertwine and affect one another. Hypertension and arteriosclerosis impact one another and are implicated in CAD. Sometimes, the electrical system does not function normally, causing dysrhythmias and even cardiac arrest, which have been elaborated on through the disorders and interventions.

18.3 Factors Affecting Cardiopulmonary Function

When cardiopulmonary function is not performing properly, the physiological impacts can range from asymptomatic to severe and even life threatening. Some examples of disorders and dysfunctions affecting the cardiopulmonary system have been presented and discussed. Additionally, contributors to the development of such physiological concerns, including those risk factors considered nonmodifiable, such as genetics and age, as well as lifestyle decisions and behaviors that promote or prevent the development of cardiopulmonary diagnoses are discussed. Genetic input is not something that can be erased, although some negative impacts may be slowed or prevented by positive lifestyle and behavioral actions and decisions. Similarly, negative choices and decisions can have negative physical results.

Health status is also a factor in cardiopulmonary dysfunction. Comorbidities have a negative influence on a patient's ability to physically (and perhaps mentally) come through the problems that accompany malfunctions of the cardiac or pulmonary systems. As critical as this combined system is, the impacts may not only be obvious from the primary diagnosis but may be more insidious and be based on a secondary or tertiary effect.

Finally, a variety of diagnostic tests were investigated—from laboratory blood studies like cultures to arterial or venous blood gases to analyze acid-base balance and respiratory status, to monitoring devices such as pulse oximeter and capnography. Some of the components of PFTs were presented, although this practice area is quite specialized, with many details specific to pulmonology care. Since the electrical system is so vital to cardiovascular function, electrocardiograms were explored, with a focus on the entry-level, generalist nurse.

18.4 Management of Impaired Cardiopulmonary Functioning

The nursing roles in care of the cardiopulmonary patient can be varied and may take place in varied settings. Care of chronic disorders may happen most often in outpatient settings: physician's offices, clinics, or home care. Acute care and emergent care involve inpatient settings, and recovery, either between exacerbations or complete, is likely

to entail rehabilitation. Nursing care may include total, intensive care, or focus more on maximizing an individual's recovery and return to best function.

Nurses caring for patients with cardiopulmonary dysfunction should be vigilant and compassionate in their care delivery. Patient status can change rapidly, so frequent assessment is necessary. Prevention of complications is important; therefore, helpful practices like assertive pulmonary toilet should be employed to prevent atelectasis and possibly pneumonia. The importance of pain and anxiety control and other comfort measures cannot be diminished throughout the provision of care.

The nurse is not alone in the provision of cardiopulmonary care but is a member of an interdisciplinary team. Team members work in concert to coordinate the various aspects of patient status and goals, as well as the different care available through specialists in medicine, nursing, and other care providers. Cardiopulmonary emergencies benefit from the fast identification of the circumstance and immediate collaboration and action of the interdisciplinary team. The nurse works very closely with advanced practitioners—physicians, nurse practitioners, and physician's assistants—collaborating during routine and emergent care. The professional interaction during emergencies offers respect and recognition for all team members, from frequent nursing assessment to chest tube placement, or necessary advanced airways and mechanical ventilation. Respiratory therapists assist with intubations and set up and manage ventilators; radiology personnel take and read x-rays; and entire collaborative teams manage arrest situations in an organized manner to maximize the patient's outcome. Throughout a patient's journey, all sorts of multidisciplinary players contribute their expertise through varied therapies and support.

Key Terms

advanced cardiac life support (ACLS) enhanced training and skills beyond basic life support (BLS), primarily involving the addition of resuscitation and cardiac support medications
afterload the force the ventricles must generate to pump blood against the resistance in the vessels
arteriosclerosis stiffening of the arterial walls
artery a blood vessel that carries blood away from the heart
atelectasis the collapse of alveoli in the lungs, resulting in limited air movement and decreased gas exchange
atherosclerosis buildup of plaque deposits within the artery walls
automated external defibrillator (AED) an easy-to-use portable device available in many settings that can analyze a cardiac rhythm and defibrillate, if appropriate, in order to reestablish an effective cardiac rhythm
automaticity the ability of cells to initiate spontaneous action potential
bronchiectasis a chronic condition where airways are dilated and the lung walls are thickened due to inflammation and infection
capnography CO_2 monitor
cardiomyocytes heart muscle cells
cardiopulmonary resuscitation (CPR) combination of rescue breathing and chest compressions
cardiopulmonary system combination of cardiovascular and pulmonary systems
cardioversion use of low-dose electricity to convert the cardiac electrical system from a dysrhythmia (e.g., A-fib) to normal sinus rhythm
carina the ridge of cartilage at the base of the trachea that separates the openings of the left and right primary bronchi
comorbidity multiple medical diagnoses
compliance the ability of the lungs to accommodate deep and shallow breaths and maintain elastic recoil
contractility pumping action of the heart
crepitus a popping or crackling sensation when the skin is palpated; it is a sign of air trapped under the subcutaneous tissues
cyanosis a bluish or dusky discoloration of the skin and mucous membranes caused by hypoxia
dysrhythmia a rhythm abnormality
ejection fraction (EF) the percentage of blood within the ventricle that is expelled during a single systolic contraction
electrocardiogram the visual interpretation of the electrical impulses involved in the cardiac cycle
epiglottis a flexible piece of cartilage that covers the opening of the trachea during swallowing to prevent ingested material from entering the trachea

esophagus part of the gastrointestinal tract: tubular structure adjacent to trachea which transports food and fluid boluses from the mouth to stomach
expiration the movement of air out of the lungs
false vocal cords mucosal tissue located within the glottis; also known as vestibular folds
fibrosis abnormal scar tissue
gas exchange the transfer of oxygen and carbon dioxide; takes place at the alveolar-capillary bed
glottis the opening between vocal folds; includes true vocal cords and the opening between them
hypercapnia an elevated CO_2
hyperventilation rapid, deep breathing
hypoxemia decreased partial pressure of oxygen in the blood (PaO_2)
hypoxia a reduced level of tissue oxygenation
inspiration the movement of air into the lungs
intravascular volume the amount of fluid within the blood vessels
ischemia a condition in which oxygen-rich blood flow is restricted or reduced in a part of the body
isoelectric line the flat horizontal line on ECG paper, reflecting no electrical voltage (positive or negative)
laryngopharynx lower portion of the throat, located behind the larynx
larynx tubular airway structure at the superior part of the trachea that connects the pharynx to the trachea and helps regulate the volume of air that enters and leaves the lungs; contains the vocal cords
mediastinum the space within the thoracic cavity, medially between the lungs
metabolic syndrome a cluster of diseases (including hypertension, high blood sugar levels, a large waistline or apple shape, high triglycerides, low HDL cholesterol) that occur together, increasing a person's chances of developing heart disease
nasal turbinates folded mucosal tissues offering protection, warmth, and humidity to the nasal cavity; also known as conchae
nasopharynx superior part of pharynx, connecting nose and trachea
oropharynx middle portion of pharynx, including tonsils and base of tongue, connecting to trachea
perfusion vascular circulation powered by the pumping action of the heart that delivers oxygen and other nutrients to body tissues
pharynx muscular tube that connects the nasal cavity and mouth to the voice box (larynx) and the esophagus (food pipe); also known as the throat
postural drainage use of gravity/positioning to enhance drainage of respiratory secretions
preload the stretch on the ventricles prior to contraction
pulse oximeter instrument that measures the oxygen saturation of the blood
respiration a general term for breathing and ventilation; composed of inhalation and exhalation
respiratory ventilation the act of breathing; associated with oxygenation
rhythm strip a tracing of the electrical cycles as seen from a selected lead, usually representing six seconds
sinuses cavities located bilaterally in various areas of the skull; identified by the nearby bones
spirometry pulmonary function test measuring the amount and speed of air movement on inhalation and exhalation
stroke volume the volume of blood pumped out of the left ventricle of the heart during each systolic cardiac contraction
subcutaneous emphysema air trapped in the subcutaneous tissue
surfactant a phospholipid compound that reduces surface tension of alveoli, thereby preventing alveolar collapse (atelectasis)
tachycardia heart rate faster than 100 beats per minute
tachypnea a respiratory rate that exceeds 20 breaths per minute
tidal volume length and depth of breaths
trachea the lowest structure of the upper airway, adjacent to the esophagus, that connects the lung bronchi and the larynx and provides a route for air to enter and exit the lungs; also known as the windpipe
true vocal cords structures within the glottis with muscular attachments to the thyroid and laryngeal cartilage; movement at the inner aspects produces sound production mechanism
valve promotes the unidirectional flow of blood toward the heart and prevents backflow in a vein
vein a blood vessel that returns blood to the heart

venous reserve percentage of venous blood located in venous networks within the liver, bone marrow, and integument

ventilation the movement of air in and out of the lungs

Assessments

Review Questions

1. What laboratory result is indicative of hypercapnia?
   a. PaO_2 68 mm Hg
   b. $PaCO_2$ 24 mm Hg
   c. HCO_3 24 mEq/L
   d. $PaCO_2$ 50 mm Hg

2. Diffusion works by which method of molecular movement?
   a. Molecules move from the intravascular space to the surrounding tissue.
   b. Movement of molecules is from interstitial to intravascular space.
   c. Molecular movement is from high to low concentration along a gradient.
   d. Molecules are moved across a filter by expenditure of ATP.

3. What substance is a powerful vasoconstrictor, synthesized by reactions of the kidneys and the lungs?
   a. aldosterone
   b. angiotensin II
   c. renin
   d. angiotensin I

4. What substance reduces alveolar surface tension, thereby preventing the collapse of alveoli?
   a. surfactant
   b. macrophage
   c. bradykinin
   d. prostaglandin

5. What patient's respiratory status would a nurse in the emergency department be *most* concerned about?
   a. 68-year-old with fifty-pack-year smoking history
   b. 52-year-old with brainstem infarction
   c. 45-year-old with right lower lobe pneumonia
   d. 34-year-old with latent tuberculosis

6. A nursing student who is preparing to educate a patient on the use of the incentive spirometer practices by telling the preceptor the patient will be told to use what technique?
   a. "Inhale through the mouthpiece like a thick milkshake through a straw."
   b. "Blow into the mouthpiece as hard as you can for as long as you can."
   c. "Breathe in and out through the mouthpiece quickly ten times in ten seconds."
   d. "Cough into the mouthpiece to see if the regulator rises to the goal."

7. Norepinephrine enhances perfusion by what mechanism?
   a. dilates blood vessels
   b. produces hypotension
   c. causes vasoconstriction
   d. normalizes temperature

8. The combined processes of cellular respiration and gas exchange are referred to by what terminology?
   a. ventilation
   b. perfusion

c. internal respiration
d. Kreb cycle

9. The impulse of the normal cardiac electrical cycle travels from the SA node to the AV node, then to which structure?
a. Purkinje fibers
b. bundle of His
c. ventricular wall
d. interventricular septum

10. A nurse anticipates what symptom from a patient who has low CO?
a. clammy skin
b. clear mentation
c. bradycardia
d. robust pedal pulses

11. Metabolic syndrome is associated with what combination of diagnoses?
a. hyperglycemia, central obesity, hypertension
b. high triglycerides, high HDL, hyperglycemia
c. hypertension and severe obesity
d. high triglycerides, low HDL, hypoglycemia

12. Acid-base balance is reflected by what factor?
a. $PaCO_2$
b. pH
c. PaO_2
d. HCO_3

13. A nurse is educating a patient about lifestyle choices; what behavior is of most concern for respiratory implications?
a. sedentary activity level
b. high sodium intake
c. 150 minutes of moderate walking
d. smoking

14. The amount and rate of inspiration and expiration of air are measured by what test?
a. oximetry
b. capnography
c. spirometry
d. PEFR

15. The telemetry nurse notices a patient's HR has slowed to 45 beats/minute; upon reviewing the continuous ECG monitor, no P-waves are visible, but the QRS complexes are regular. The nurse prepares to call to inform the cardiologist of what suspected issue?
a. The patient is in HF.
b. An MI is occurring.
c. A-fib has developed.
d. The SA node is not firing.

16. A nurse reads a postintubation chest x-ray report that indicates a patient has subcutaneous emphysema in the anterior right chest, near the clavicle. What assessment finding should the nurse anticipate in this region?
a. no breath sounds
b. crepitus

c. alkalosis
d. wheezing

17. A patient is admitted for an acute-on-chronic exacerbation of emphysema. What powerful class of drugs does the nurse expect to be prescribed to treat the acute inflammatory process?
a. decongestant
b. expectorant
c. corticosteroid
d. antitussive

18. An unresponsive patient who is not breathing and whose cardiac rhythm is identified as VF is a candidate for what emergency intervention?
a. cardioversion
b. O_2 by CPAP
c. IV sedation
d. defibrillation

19. A patient with secretions in bilateral anterior upper lobes of the lungs has been taking guaifenesin, has undergone chest physiotherapy to include percussion of the upper anterior chest, and is now to be positioned for postural drainage. In what position will the nurse place the patient?
a. Trendelenburg
b. supine and flat
c. prone
d. high Fowler

Check Your Understanding Questions

1. How does the pneumotaxic center affect the respiratory rate?

2. What is meant by the term *automaticity*?

3. What dietary patient teaching should the nurse provide to a patient recently diagnosed with hypertension?

4. Which three techniques are helpful for removal of excess CO_2 and promotion of airway clearance?

Reflection Questions

1. A nursing student notices an ICU nurse pays closer attention to a patient's cardiac index (CI) than CO on the monitor. Why is the nurse focusing more on the CI?

2. Describe the benefit of the traffic light system for patient education regarding peak flow results.

3. Consider the members who make up an interdisciplinary healthcare team. Describe which team members are likely to be involved in a cardiopulmonary arrest situation and reflect on the interaction of roles and how the players collaborate toward positive outcomes.

Critical-Thinking Questions about Case Studies

1. Refer to Unfolding Case Study #3: Part 7.
Which type of HF (right or left), do you think the patient is experiencing? What makes you think that?

2. Refer to Unfolding Case Study #3: Part 8.
What oxygen delivery device is most appropriate for the nurse to use?

What Should the Nurse Do?

An unresponsive patient has been brought to the emergency department, and an ABG is performed. Results indicate a pH of 7.24 and CO_2 of 52. The nurse notes the patient's respiratory rate is 26.

1. Based on the definition of hyperventilation, is this patient hyperventilating?

2. Why is the patient tachypneic?
3. A patient who experienced a MI with significant myocardial tissue damage two weeks ago now has a diagnosis of HF. The nurse notes these recent test and hemodynamics results: T: 98.8°F (37.1°C), HR 122, BP 86/48, RR 16, CO 3.9, CI 1.8. Echocardiogram report includes bilateral ventricles with minimal wall motion and low SV. What results would illustrate signs and symptoms associated with HF?
4. A patient presents to the ED with complaint of 10/10 chest pain. The receiving nurse notes the patient is ashen and diaphoretic. Vital signs are as follows: temperature 98.8°F (37.1°C), HR 112, BP 84/56, RR 24, SaO_2 94 percent on 2 L O_2 by nasal cannula (NC). As the leads are being placed for a twelve-lead ECG, the patient says to the nurse, "Please don't let me die!" and loses consciousness. The nurse checks for a carotid pulse, but there is none, so the code button is pushed to activate the code team. While awaiting the team's arrival and the code cart, which action should the nurse take first?

Competency-Based Assessments

1. A nurse is caring for a patient awaiting cardiac catheterization who had 9/10 chest pain, reduced to 4/10 on a nitroglycerin IV drip. Which patient assessment findings should the nurse consider to determine whether to increase the rate of nitroglycerin? *Select all that apply.*
   A. temperature
   B. BP
   C. HR
   D. pain scale
   E. respiratory rate

2. The new graduate nurse prepares to place leads for continuous three-lead cardiac telemetry monitoring: in addition to the ground, at which locations should leads be placed?
   a. right arm and both legs
   b. both arms and left leg
   c. left and right second intercostal space
   d. xiphoid process and left arm

3. Review the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 19

Fluids, Electrolytes, and Elimination

FIGURE 19.1 Successful regulation of fluid and electrolytes is a vital component to maintaining homeostasis within the human body. (credit: modification of "U.S. Navy Sailors spend time working in Valleywise Medical Center supporting the community" by Navy Medicine/ Flickr, Public Domain)

CHAPTER OUTLINE

19.1 Fluid and Electrolytes
19.2 Nursing Assessment for Fluid and Electrolytes
19.3 Considerations for Fluid and Electrolyte Imbalances
19.4 Nursing Management of Elimination

INTRODUCTION In a healthy state, the mass of the human body mass is 50 percent to 80 percent water (Lorenzo et al., 2019). The water percentage variances occur because of differences in lean muscle versus fat. Lean muscle consists of approximately 70 percent water, whereas fat is only approximately 10 percent water (Lorenzo et al., 2019). For this reason, even in healthy individuals, age and activity status have a significant impact the risk for excess or deficiency of body water. Young children who have yet to develop significant lean muscle, older adults who have lost lean muscle, and individuals who, for a variety of reasons, have differing levels of lean muscle are at greater risk for a water deficit.

The human body maintains a delicate balance of fluids and electrolytes to help ensure proper functioning and homeostasis. When fluid or electrolyte levels become imbalanced, individuals are at risk for organ system dysfunction. If an imbalance goes undetected and is left untreated, organ systems cannot function properly and, ultimately, death will occur. Nurses must be able to recognize subtle changes in fluid or electrolyte balances in their patients so they can intervene promptly. Timely assessment and intervention prevent complications and save lives.

19.1 Fluid and Electrolytes

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify factors affecting fluid balance
- Recognize factors affecting electrolyte balances
- Describe the homeostatic mechanisms of fluid and electrolyte balance

The nurse makes inferences about the amount and location of fluid in the patient's body by assessment of subjective and objective data, including laboratory test values. Before learning about how to care for patients with fluid and electrolyte imbalances, it is important to understand the physiological processes of the body's regulatory mechanisms. The body is in a constant state of change as fluids and electrolytes are shifted in and out of cells within the body in an attempt to maintain a nearly perfect balance, or **homeostasis**, the maintenance of equilibrium of two or more interdependent elements. In this chapter, the interdependent elements are fluids and electrolytes. A slight change in either direction—high or low—can have significant consequences on various body systems. This unit reviews how fluid is regulated in the body and the importance of electrolyte balance.

Fluid Balance

Body fluids consist of water, electrolytes, blood plasma and component cells, proteins, and other soluble particles called **solute**s. Body fluids are found in two main areas of the body called intracellular and extracellular compartments (Figure 19.2).

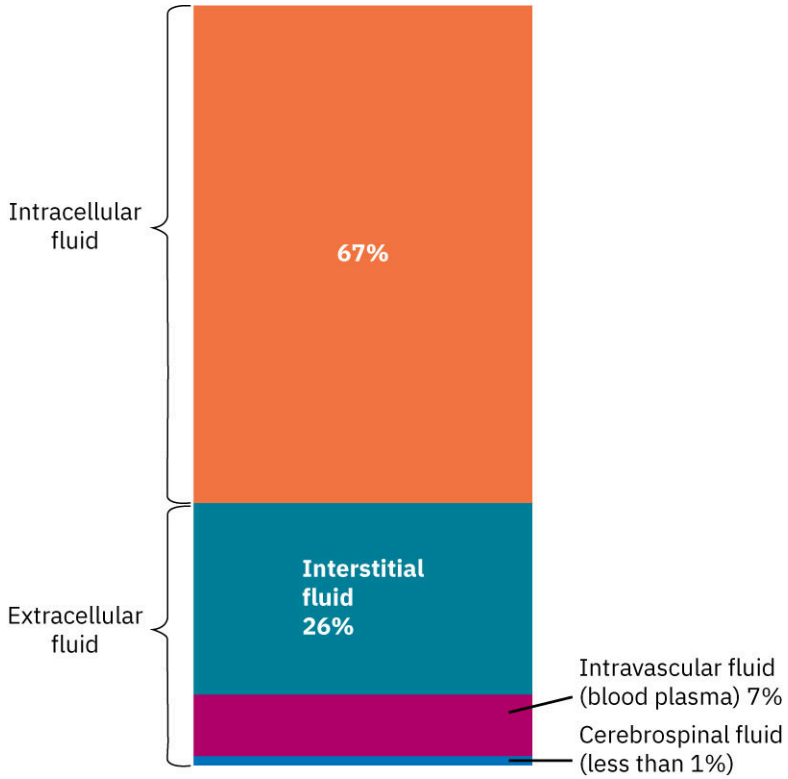

FIGURE 19.2 Although cerebral spinal fluid is extremely important in protecting the brain and spinal cord, it makes up less than 1 percent of total body fluid. The remaining total body fluid is composed of 7 percent blood plasma, 26 percent interstitial fluids, and 67 percent intracellular fluids. (credit: modification of "Cellular Fluid Content" by "Welcome1To1The1Jungle"/Wikimedia Commons, CC BY 4.0)

The intracellular compartment contains **intracellular fluid (ICF)** that is made up of protein, water, electrolytes, and solutes. The most abundant electrolyte in ICF is potassium. Intracellular fluids are crucial to the body's functioning. In fact, ICF accounts for 60 percent of the volume of body fluids and 40 percent of a person's total body weight (Lorenzo et al., 2019).

Fluid outside of cells is called **extracellular fluid (ECF)**. The most abundant electrolyte in ECF is sodium. The body regulates sodium levels to control the movement of water into and out of the extracellular space due to osmosis.

Extracellular fluids can be further broken down into various types. The first type is known as **intravascular fluid** and it is found in the vascular system that consists of arteries, veins, and capillary networks. Intravascular fluid is whole blood volume and includes red blood cells, white blood cells, plasma, and platelets. Intravascular fluid is the most important component of the body's overall fluid balance.

Loss of intravascular fluids causes the nursing diagnosis deficient fluid volume, also referred to as hypovolemia. Intravascular fluid loss can be caused by several factors, such as excessive diuretic use, severe bleeding, vomiting, diarrhea, and inadequate oral fluid intake. If intravascular fluid loss is severe, the body cannot maintain adequate blood pressure and perfusion of vital organs. This can result in hypovolemic shock and cellular death when critical organs do not receive an oxygen-rich blood supply needed to perform cellular functions.

A second type of ECF is **interstitial fluid** which refers to fluid outside of blood vessels and between the cells. For example, if you have ever cared for a patient with heart failure and noticed increased swelling in the feet and ankles, you have seen an example of excess interstitial fluid referred to as **edema**. This is because heart failure is ineffective pumping of blood, which causes the pooling of blood, which increases the pressure on vessels, which "leak" fluid into the interstitial spaces. The remaining ECF, also called **transcellular fluid**, refers to fluid in areas such as cerebrospinal, synovial, and intrapleural spaces, and the gastrointestinal (GI) system.

Intravascular fluid volume is assessed through perfusion indicators. Perfusion is the delivery of blood and, therefore, essential oxygen and nutrients to organs and tissues. External indicators of intravascular fluid delivery include blood pressure, peripheral pulse characteristics, and end organ function. End organ function assessment includes collecting data to determine if the organ is manifesting adequate blood delivery. Within fluid and electrolyte assessments, end organ assessment often is focused on the kidneys and includes monitoring kidney function measurements such as serum blood urea nitrogen (BUN) and creatinine levels and glomerular filtration rate, monitoring urine output quantity and characteristics, and monitoring urine laboratory data (Table 19.1).

Organ or Body System	Objective Assessment Data
Kidney	BUN and creatinine levels Electrolyte levels Urine output Urine specific Gravity
Heart	Atrial natriuretic peptides Cardiac biomarkers
Liver	Bilirubin levels Liver enzyme levels
Nervous	Level of orientation Muscle strength

TABLE 19.1 Examples of End Organ Perfusion Assessment Data

Fluid Movement

Fluid movement occurs inside the body due to osmotic pressure, hydrostatic pressure, and osmosis. Proper fluid movement depends on intact and properly functioning vascular tissue lining, normal levels of protein content within the blood, and adequate hydrostatic pressures inside the blood vessels. Intact vascular tissue lining prevents fluid from leaking out of the blood vessels. Protein content of the blood (in the form of albumin) causes **oncotic pressure** that holds water inside the vascular compartment. Oncotic pressure refers to the condition in which the osmotic force that allows fluid to remain in the vascular space is predominantly proteins. For example, patients with decreased protein levels (such as low serum albumin) experience edema due to the leakage of intravascular fluid into interstitial areas because of decreased oncotic pressure.

The pressure that a contained fluid exerts on what is confining it is called hydrostatic pressure. In the intravascular fluid compartment, hydrostatic pressure is the pressure exerted by blood against the capillaries. Hydrostatic

pressure opposes oncotic pressure at the arterial end of capillaries, where it pushes fluid and solutes out into the interstitial compartment. On the venous end of the capillary, hydrostatic pressure is reduced, which allows oncotic pressure to pull fluids and solutes back into the capillary (Figure 19.3).

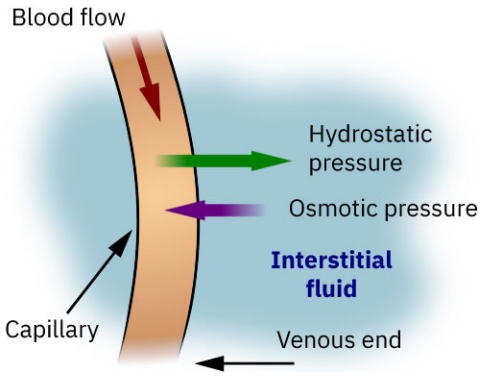

FIGURE 19.3 Capillary microcirculation involves hydrostatic and osmotic pressures that move molecules across the capillary wall. (credit: "Capillary microcirculation" by "Kes47"/Wikimedia Commons, Public Domain)

The process of **filtration** occurs when hydrostatic pressure pushes fluids and solutes through a permeable membrane so they can be excreted. An example of this process is fluid and waste filtration through the glomerular capillaries in the kidneys. This filtration process within the kidneys allows excess fluid and waste products to be excreted from the body in the form of urine.

Fluid movement is also controlled through **osmosis**. Osmosis is water movement through a semipermeable membrane, from an area of lesser solute concentration to an area of greater solute concentration, in an attempt to equalize the solute concentrations on either side of the membrane. Only fluids and some particles dissolved in the fluid can pass through a semipermeable membrane; larger particles are blocked from getting through. Because osmosis causes fluid to travel due to a concentration gradient, and no energy is expended during the process, it is referred to as passive transport.

Osmosis causes fluid movement among the intravascular, interstitial, and ICF compartments on the basis of solute concentration. For example, recall a time when you have eaten a large amount of salty food. The sodium concentration of the blood becomes elevated. Due to the elevated solute concentration within the bloodstream, osmosis causes fluid to be pulled into the intravascular compartment from the interstitial and intracellular compartments to try to equalize the solute concentration. As fluid leaves the cells, they shrink. The shrinkage of cells is what causes many symptoms of dehydration, such as dry, sticky mucous membranes. Because the brain cells are especially susceptible to fluid movement due to osmosis, a headache may occur if adequate fluid intake does not occur.

Solute Movement

Solute movement is controlled by **diffusion**, active transport, and filtration. Diffusion is the movement of molecules from an area of higher concentration to an area of lower concentration to equalize the concentration of solutes throughout an area. (Note that diffusion is different from osmosis because osmosis is the movement of fluid, whereas diffusion is the movement of solutes.) Because diffusion travels down a concentration gradient, the solutes move freely without energy expenditure (Figure 19.4). An example of diffusion is the movement of inhaled oxygen molecules from alveoli to the capillaries in the lungs so that they can be distributed throughout the body.

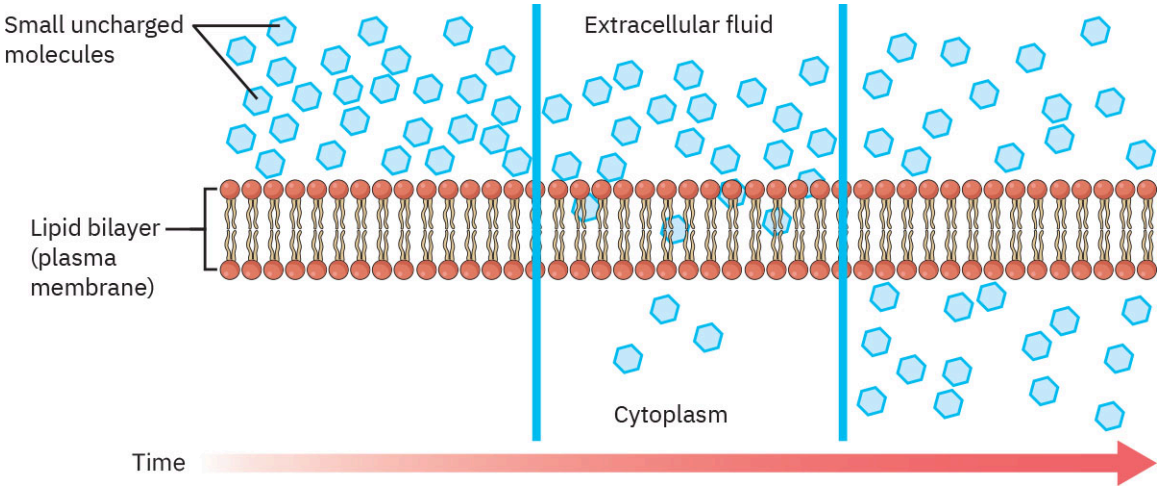

FIGURE 19.4 The structure of the cell membrane allows diffusion of uncharged substances, like oxygen and carbon dioxide, to pass through the cell membrane down their concentration gradient in a process known as diffusion. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Unlike diffusion, **active transport** involves moving solutes and ions across a cell membrane from an area of lower concentration to an area of higher concentration. Because active transport moves solutes against a concentration gradient to prevent an overaccumulation of solutes in an area, energy is required for this process to take place. An example of active transport is the sodium-potassium pump, which uses energy to maintain higher levels of sodium in the ECF and higher levels of potassium in the ICF (Figure 19.5). Recall that sodium ion (Na^+) is the primary electrolyte in the extracellular space and potassium ion (K^+) is the primary electrolyte in the intracellular space.

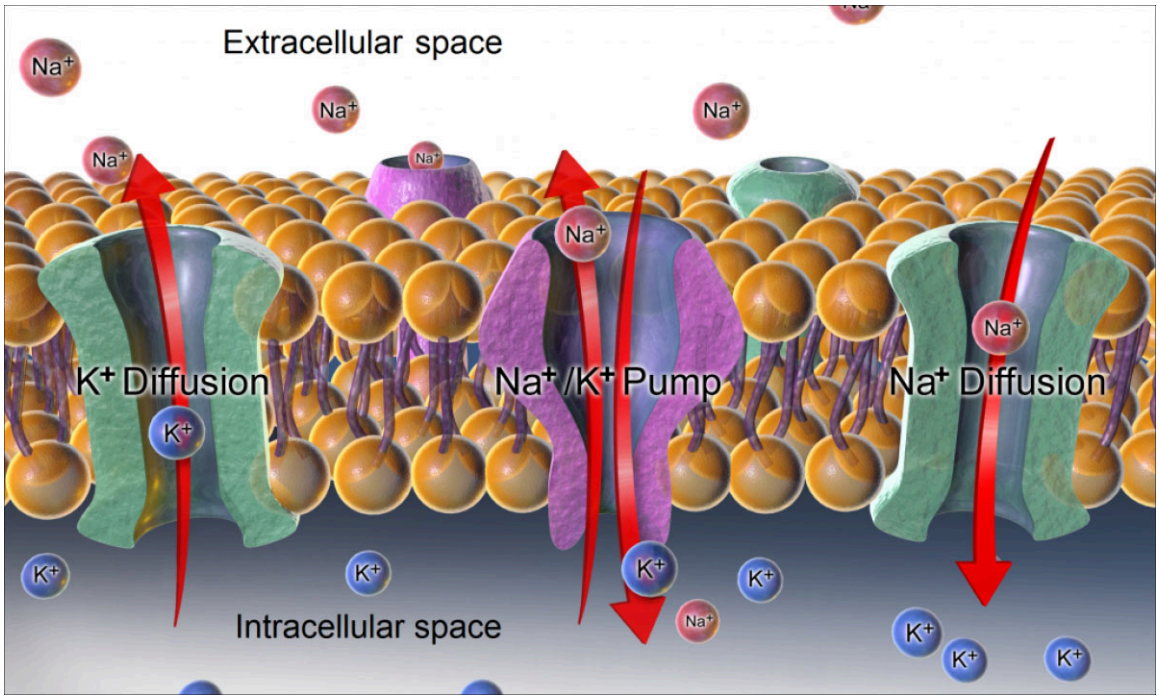

FIGURE 19.5 Diffusion and the sodium-potassium pump regulate sodium and potassium levels in the extracellular and intracellular compartments. (credit: modification of "Sodium-potassium pump and diffusion" by "BruceBlaus"/Wikimedia Commons, CC BY 3.0)

Fluid and Electrolyte Regulation

The body must carefully regulate intravascular fluid accumulation and excretion to prevent FVEs or deficits and maintain adequate blood pressure. Water balance is regulated by several mechanisms, including antidiuretic hormone (ADH), thirst, and the renin-angiotensin-aldosterone system (RAAS).

Fluid intake is regulated by thirst. As fluid is lost and the sodium level increases in the intravascular space, serum osmolality increases. Serum **osmolality** is a measure of the concentration of dissolved solutes in the blood.

Osmoreceptors in the hypothalamus sense increased serum osmolarity levels and trigger the release of ADH in the kidneys to retain fluid. The osmoreceptors also produce the feeling of thirst to stimulate increased fluid intake. However, individuals must be able to mentally and physically respond to thirst signals to increase their oral intake. They must be alert, fluids must be accessible, and the person must be strong enough to reach for fluids. When a person is unable to respond to thirst signals, dehydration occurs. Older individuals are at increased risk of dehydration due to age-related impairment in thirst perception. The average adult intake of fluids is approximately 2,500 mL/d from both food and drink. An increased amount of fluids is needed if the patient has other medical conditions causing excessive fluid loss, such as sweating, fever, vomiting, diarrhea, and bleeding.

The RAAS plays an important role in regulating fluid output and blood pressure (Figure 19.6). When there is decreased blood pressure (which can be caused by fluid loss), specialized kidney cells make and secrete renin into the bloodstream. Renin acts on angiotensinogen released by the liver and converts it to angiotensin I, which is then converted to angiotensin II. Angiotensin II does a few important things. First, angiotensin II causes vasoconstriction to increase blood flow to vital organs. It also stimulates the adrenal cortex to release aldosterone.

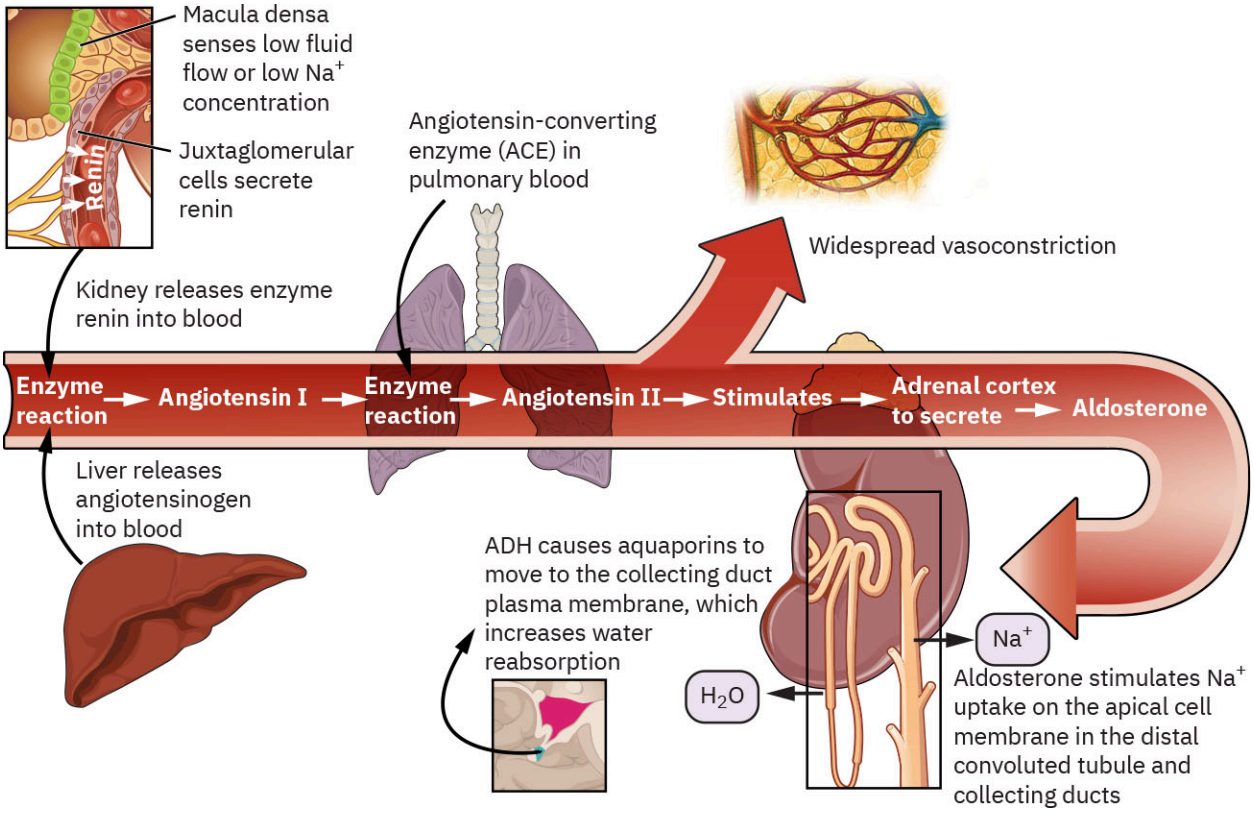

FIGURE 19.6 The RAAS is vital in regulating fluid and blood pressure. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Aldosterone is a steroid hormone that triggers increased sodium reabsorption by the kidneys and subsequent increased serum osmolality in the bloodstream. As you recall, increased serum osmolality causes osmosis to move fluid into the intravascular compartment in an effort to equalize solute particles. The increased fluids in the intravascular compartment increase circulating blood volume and help raise the person's blood pressure. An easy way to remember this physiological process is "aldosterone saves salt" and "water follows salt."

Fluid output occurs mostly through the kidneys in the form of urine. Fluid is also lost through the skin as perspiration, through the GI tract in the form of stool, and through the lungs during respiration. Forty percent of daily fluid output occurs due to these "insensible losses" through the skin, GI tract, and lungs and cannot be measured. The remaining 60 percent of daily fluid output is in the form of urine. Normally, the kidneys produce approximately 1,500 mL of urine per day when fluid intake is adequate. Decreased urine production is an early sign of dehydration or kidney dysfunction. It is important for nurses to assess urine output in patients at risk. If a patient outputs less than 30 mL/h (or 0.5 mL/kg/h) of urine output over 8 hours, the provider should be notified for prompt intervention.

Fluid Imbalance

Two types of fluid imbalances are deficient fluid volume (referred to as **hypovolemia**) and excessive fluid volume (referred to as **hypervolemia**). These imbalances primarily refer to imbalances in the extracellular compartment, but they can cause fluid movement in the intracellular compartments, depending on the sodium level of the blood.

Fluid Volume Deficit

A **fluid volume deficit (FVD)** can occur from a loss of body fluids or fluid that becomes unavailable in the body for use. The next section discusses the differences between hypovolemia and third spacing. Fluid volume deficit (also referred to as hypovolemia or dehydration) occurs when loss of fluid is greater than fluid input. Common causes of deficient fluid volume are diarrhea, vomiting, excessive sweating, fever, and poor oral fluid intake.

The nurse must also understand that because fluid can move between compartments, one compartment may be adequate while, at the same time, another compartment is volume deficient or volume excessive. Several terms are used to describe a deficient fluid volume. The term dehydration is used when fluid volume deficiency exists in the interstitial space. When dehydration occurs, the patient may complain of being thirsty, and mucus membranes, especially those in the oral cavity, will look and feel sticky or dry. If dehydration is significant, **enophthalmos** (or sunken eyes) may be visible, skin turgor may be poor, and skin may look dry.

Dehydration can lead to headaches, and some studies indicate even mild dehydration can decrease cognitive function. As tissue size decreases, pain receptors are stimulated, and patients experience pain. In severe cases, cerebral tissue can shrink, damaging the protective meningeal layers, and cause cerebral bleeding.

Hypovolemia

Deficient fluid volume (also referred to as hypovolemia or dehydration) occurs when loss of fluid is greater than fluid input. Common causes of deficient fluid volume are diarrhea, vomiting, excessive sweating, fever, and poor oral fluid intake. Individuals who have a higher risk of dehydration include (Table 19.2):

- individuals who exercise or work outdoors in hot weather,
- infants and children,
- older adults,
- patients taking diuretics and other medications that cause increased urine output, and
- patients with chronic diseases such as diabetes mellitus and kidney disease.

Adults	Infants and Young Children
Changes in mental status Dark, concentrated urine Dizziness due to decreased blood pressure Dry mouth Dry skin Elevated heart rate Feeling tired Feeling very thirsty Headache Urinating and sweating less than usual	Additional symptoms include: • being unusually sleepy or drowsy • crying without tears • eyes that look sunken • irritability • no wet diapers for three hours or more • sunken fontanel

TABLE 19.2 Signs and Symptoms of Dehydration

Dehydration can be mild and treated with increased oral intake such as water or sports drinks. Severe cases can be life-threatening and require the administration of intravenous fluids (IVFs).

Third-Spacing Fluid Shift

The term **third spacing** refers to a type of hypovolemia in which total body fluid may be adequate or even excessive but fluid has moved out of the intravascular space and into the interstitial space, making it unavailable. Third spacing can be consequence of inflammation or a loss of intravascular oncotic pressure.

Inflammation is an immune system response that results in many of the traditional manifestations we experience

when we get sick, such as runny nose, cough, and body aches, among others. Certain kinases and cytokines that are released in the body as part of the inflammatory process cause capillary leaking. Capillary leaking is a normal and useful response for the body to deliver white blood cells, red blood cells, platelets, and other immune mediators to the site of an injury or infection. However, on a larger scale, capillary leaking can potentially cause large amounts of fluid to leak out of the capillary networks and into the tissues. Patients experiencing significant trauma or severe infections and sepsis can become hypovolemic as fluid leaves the intravascular space and stays in the interstitial space.

Intravascular oncotic pressure derives from the number of intravascular solutes compared with the amount of intravascular fluid. The most abundant intracellular solute is sodium, and the largest intravascular solutes are plasma proteins and glucose, in that order. When a disease causes the concentration of intravascular sodium, proteins, or glucose to decrease, there is not adequate oncotic pull to keep fluid in the vascular system, and fluid leaks into the interstitial space. Whether third spacing is a result of inflammation or loss of oncotic pressure, the manifestations are like that of hypovolemia, except with the addition of interstitial space congestion and swelling, which is called edema.

Fluid Volume Excess

Hypervolemia, also referred to as **fluid volume excess (FVE)**, occurs when there is increased fluid retained in the intravascular compartment. Patients at risk for developing FVE are those with the following conditions:

- cirrhosis
- heart failure
- kidney failure
- pregnancy

Symptoms of fluid overload include pitting edema, ascites, and dyspnea and crackles from fluid in the lungs. Edema is swelling in dependent tissues due to fluid accumulation in the interstitial spaces. Ascites is fluid retained in the abdomen. Treatment depends on the cause of the fluid retention. Sodium and fluids are typically restricted, and diuretics are often prescribed to eliminate the excess fluid.

CLINICAL JUDGMENT MEASUREMENT MODEL

Form a Hypothesis: Differentiating FVE and Edema from Third Spacing

A patient presents to the emergency department with complaints of a headache and swollen ankles. Although headache and peripheral edema are both manifestations of FVE, there is not enough information to determine if these manifestations are from FVE due to increased hydrostatic pressure or from third spacing due to a loss of intravascular oncotic pressure. To gather additional pertinent assessment data, the nurse should ask the patient questions and obtain a health history. The patient indicates no history of cardiac or kidney disease and states "I have been very healthy until I was recently diagnosed with meningitis. I have been on antibiotics and was feeling better, but now I have no energy and my feet are swelling."

The nurse analyzes the patient's health history information in conjunction with the presenting manifestations and determines it is unlikely the patient's headache and edema are caused by FVE. The nurse understands that fluid shifting from the intravascular space into the interstitial space can also cause headache and edema.

The nurse performs a physical assessment and determines the patient's blood pressure is 92/56 mm Hg and apical heart rate is 115 bpm. The nurse analyzes these data and determines the patient is hypovolemic. The nurse reports this information to the provider and then obtains results from a serum electrolyte panel. The patient's serum sodium level is 130 mEq/L. Subsequently, the patient is diagnosed with meningitis-induced syndrome of inappropriate antidiuretic hormone (SIADH).

Initially, the patient appeared to be experiencing FVE. However, further assessment data did not support FVE.

Hypervolemia

Hypervolemia is an FVE specific to fluid in the intravascular space. Fluid will remain in the intravascular space if intravascular oncotic pressure is high. If the normal mechanisms that control intravascular solutes are not optimal

(in this case mainly sodium and glucose), high levels will pull fluid into the intravascular space.

Hypervolemia manifests with an increase in vascular pressure. Vascular pressure can be assessed through internal or external blood pressure monitoring, by auscultating cardiac heart sounds, assessing arterial pulse characteristics, and assessing for the presence of jugular venous distention. Hypervolemia manifests as high blood pressure (hypertension), the addition of a third heart sound (S3), bounding peripheral pulses, and visible jugular veins when the patient is sitting at a 45° angle or greater (Table 19.3).

Fluid Volume Alteration	Manifestations	Laboratory Data
Dehydration	Dry, sticky mucus membranes Dry skin, skin tenting Enophthalmos Thirst	Serum sodium level normal or high If intravascular volume is maintained, most serum and urine laboratory measurements will be normal.
Hypovolemia	Decreased blood pressure with tachycardia Concentrated and darkening urine Increased respiratory rate Possible decrease in end organ perfusion Prolonged capillary refill Weak peripheral pulses, skin may feel cool	Serum values indicate: • increased BUN level • Increased hematocrit • possibly increased creatinine level Urine values indicate: • increased urine osmolality • increased urine specific gravity • increased urine osmolality
Hypervolemia	Increased blood pressure Jugular vein distension S3 Strong or bounding peripheral pulses With increased kidney excretion, urine has lighter color and output is increased.	Serum laboratory values may be low due to dilution. Urine values indicate: • decreased urine osmolality • decreased urine specific gravity

TABLE 19.3 Summary of the Manifestations of Fluid Volume Alterations

Edema

Edema is the presence of excess fluid in the interstitial space. As discussed earlier, edema can exist due to third spacing. The nurse must assess multiple indicators to determine if edema is the result of third spacing or FVE. When edema results from FVE, hydrostatic pressure has forced fluid out of the vascular space and into the interstitial space. Hydrostatic pressure is pressure exerted on the sides of capillaries as blood flows through them. If hydrostatic pressure is elevated due to hypervolemia, water will be forced out of the capillaries into the interstitial space to evenly distribute hydrostatic pressure between these two spaces. If hydrostatic pressure is equal, there is no movement of fluid back into the vascular space, and fluid remains stagnant in the interstitial space.

Edema will manifest differently depending on where it is located. In the peripheral tissue, edema presents as visibly swollen tissues (Figure 19.7). Often, edema is first visible in the lower extremities, due to gravity increasing the hydrostatic pressure in the feet, ankles, and lower legs. However, in bed-bound patients, gravitational pull may well be greatest in the buttocks, back, or backs of the legs. When edema is severe and generalized throughout the body, the term **anasarca** is used.

FIGURE 19.7 Edema is an excess of fluid buildup in tissues. When buildup is substantial, an indentation will remain when pressure is applied. This is called pitting edema. (credit: "Oedema, finger marks" by John Campbell/Flickr, Public Domain)

LINK TO LEARNING

The following two videos demonstrate how to assess for edema (https://openstax.org/r/77edema1) and how to grade and document (https://openstax.org/r/77edema2) edema.

Edema can be present in interstitial spaces that are not visible. When fluid leaks out of the capillaries surrounding the alveoli, fluid can enter the alveoli. This edema is referred to as pulmonary edema and will manifest with coarse crackles heard during auscultation, pink and frothy respiratory secretions, and a decline in the assessment indicators of adequate respiratory gas exchange. (Refer to Chapter 23 Assessment of the Thorax, Lungs, Breast, and Lymphatic System for further information on lung and oxygenation assessment.) When edema is in the interstitial space within brain tissue, the cranium limits brain tissue expansion. That pressure can compress the arteries and nerves inside brain tissue, resulting in decreased blood flow and nerve activity that will manifest as headache, seizure activity, decreased level of consciousness, and other indications of increasing intracranial pressure. This edema is called cerebral edema.

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 9

Refer back to Chapter 15 General Survey, Anthropometric Measurement, and Vital Signs, Chapter 17 Nutrition Assessment, and Chapter 18 Oxygenation and Perfusion for Unfolding Case Study Parts 1–8 to review the patient data.

Mrs. Ramirez, a 68-year-old female, is brought to the emergency room by her husband. The patient reports shortness of breath with exertion and feeling "off" for the last 3 days. She has been admitted to the medical-surgical unit for observation.

Past Medical History	Patient reports shortness of breath "gets worse with walking and only gets better after sitting down for at least 15 minutes." **Medical history:** Myocardial infarction with stents 10 years ago, heart failure, COPD [chronic obstructive pulmonary disease], GERD (gastroesophageal reflux disease), and hypertension. **Family history:** Married for 50 years, three grown children. Mother died because of Alzheimer's disease. Father alive, with hypertension and prostate cancer, currently undergoing treatment. **Social history**: Former 1 pack/day smoker, quit 20 years ago. Social drinker, 1 drink/week. **Allergies:** None **Current medications:** • aspirin (e.g., Bayer) 81 mg PO [orally] daily • carvedilol (e.g., Coreg) 6.25 mg PO twice daily • furosemide (brand name, Lasix) 40 mg PO daily • lisinopril (e.g., Zestril) 10 mg PO daily
Assessment	**1900:** **Abdominal:** Abdomen soft and nontender. Bowel sounds present in all four quadrants. Patient reports last bowel movement was yesterday. **Cardiovascular:** Sinus tachycardia on monitor, S1 and S2 present, no murmurs noted. Capillary refill <2 seconds. Peripheral +1 pitting edema noted in bilateral lower extremities. **HEENT** [head, eyes, ears, nose, and throat]**:** Symmetrical, no lesions noted. Jugular venous distension present at rest. **Integumentary:** Skin warm and intact. Mild diaphoresis noted. **Musculoskeletal:** 4/5 muscle strength in bilateral lower extremities. Limited range of motion in bilateral arms that patient reports is from old shoulder injuries. **Neurological:** Alert and oriented ×4, no deficits noted. **Respiratory:** Increased respiratory rate with labored breathing observed. Crackles in lung bases bilaterally. Patient reports dyspnea with exertion.
Flow Chart	**2000:** Blood pressure: 145/82 mm Hg Heart rate: 115 bpm Oxygen saturation: 93 percent on 2 L nasal cannula Pain: 3/10 with breathing Respiratory rate: 29 breaths/minute Temperature: 99.6 °F (37.5°C)

1. Recognize cues: What findings from the case study indicate the patient may have a fluid imbalance?
2. Analyze cues: Based on the recognized cues, what kind of fluid imbalance does the patient most likely have?

Electrolyte Balance

Fluid balance and electrolyte balance share many regulatory mechanisms. Through blood sodium concentrations, the hypothalamus detects FVE or FVD and either stimulates or suppresses the patient's thirst response and the pituitary gland's secretion of ADH. Other hormones that play a role in managing fluid volume are aldosterone from the adrenal gland and natriuretic peptide hormones released by myoendocrine cells of the atria in the heart.

The kidneys have a major role in managing fluids and electrolytes. Any electrolyte level can be altered in patients with kidney injury or disease. Additionally, calcium also has a hormonal mechanism of regulation through the thyroid hormone calcitonin and parathyroid hormone (PTH).

Sodium

A common physiological phrase is "where sodium goes, water follows." Water is attracted to sodium because sodium is the most prevalent ion found in the vascular system, making up about 90 percent of the ECF osmolality (Bernal et al., 2023). Recall that the solute concentration in the intravascular space is what holds water in there. The intravascular, extracellular normal sodium level ranges between 136 and 144 mEq/L (Cleveland Clinic, 2021). As described earlier, sodium levels are influenced by vascular fluid volume and vice versa. Regulated through hypothalamic, pituitary, adrenal, and kidney interactions, sodium balance is necessary to maintain a healthy intravascular fluid volume and to prevent third spacing.

A balanced sodium level is also necessary for nerve and muscle cell conduction and activation through the sodium-potassium pump. These proteins are a part of our cell membranes and allow an uneven exchange of sodium and potassium ions. Three sodium ions leave the cell, and two potassium ions enter the cell. The ion imbalance signals the cell to fire. An excess or deficiency of sodium ions can alter the cell response (Figure 19.8).

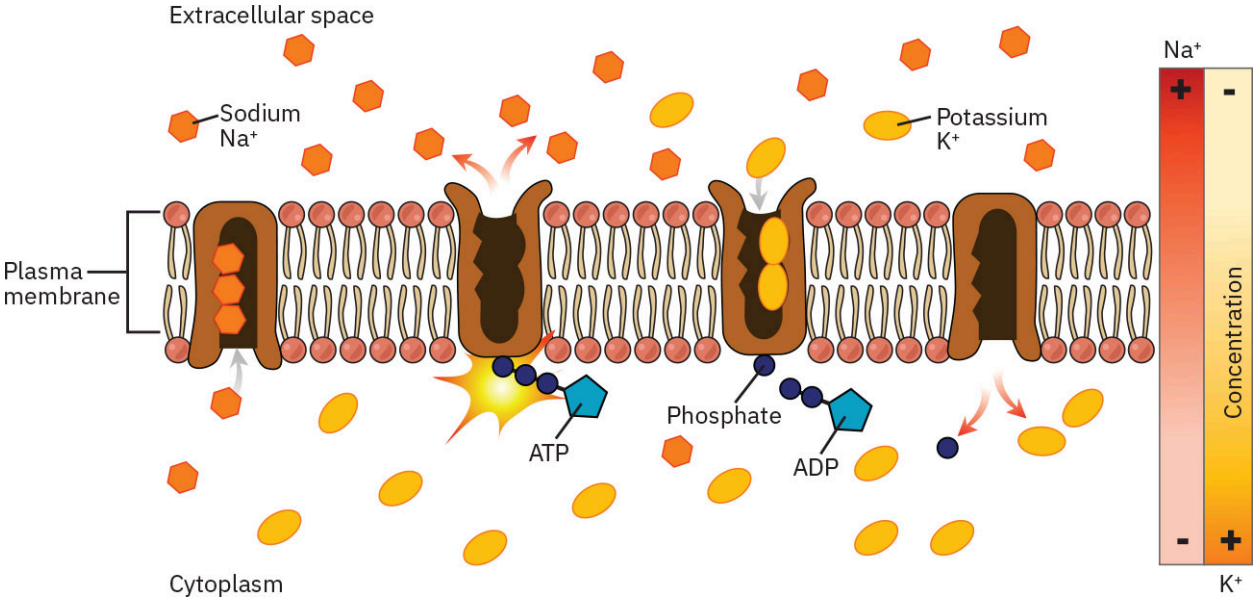

FIGURE 19.8 Sodium, potassium, and phosphate balance is necessary for the sodium-potassium pump to function. (credit: modification of *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Hyponatremia

The term **hyponatremia** refers to an intravascular, extracellular (serum) sodium level of less than 136 mEq/L. Hyponatremia is more commonly related to the loss of serum sodium, which may be due to the use of sodium-wasting diuretics, mainly thiazide diuretics, and is also common in patients experiencing GI loss from significant vomiting or diarrhea. Diuretics and GI loss decrease sodium levels, but also decrease fluid volume. This situation is called "isotonic hyponatremia" and may lead to hypovolemia. In this case, manifestation will look like those of dehydration and hypovolemia, depending on the severity of sodium and fluid loss. Hypovolemic isotonic hyponatremia can also be caused by adrenal insufficiency, in which the adrenal gland does not produce adequate aldosterone. Aldosterone is responsible for sodium retention in the vascular system and for fluid retention the vascular system. For this reason, when aldosterone is deficient, both sodium and water levels are decreased and a hypovolemic isotonic hyponatremia results.

Another type of hyponatremia is hypotonic hyponatremia. In hypotonic hyponatremia, serum sodium levels are decreased due to dilution. The vascular system can become diluted with fluid for several reasons, but a common reason is an abnormal secretion of ADH. The SIADH can be a complication of small cell lung cancer, genetic mutations (nephrogenic SIADH), or brain issues from head injuries or infections. In SIADH, water is retained in the vascular system, diluting sodium levels and causing a decreased intravascular osmotic concentration, in turn resulting in a fluid shift from the vascular space to the interstitial space. Therefore, hypotonic hyponatremia manifests as third spacing.

Hypernatremia

A serum sodium level greater than 144 mEq/L defines hypernatremia. Hypernatremia is often the result of excess dietary sodium intake. In the United States, most dietary sodium comes from salt (sodium chloride). According to the guideline published by the U.S. Department of Health and Human Services (2021), dietary sodium should not exceed 2,300 mg/d for adults and teenagers aged 14 years or older. However, the average American consumes approximately 3,400 mg of sodium each day (U.S. Food and Drug Administration, 2022).

It is important for nurses to educate the public about the risks of consuming too much sodium. Excess sodium causes the intravascular space to become hyperosmotic and fluid to move from the interstitial space into the intravascular space. As interstitial fluid is replaced, intravascular volume continues to expand, and, thus, hypertension can develop.

Dietary sodium excess is not the only cause of hypernatremia. Water deprivation can occur in people who are unable to respond to thirst or lack access to clean water. One example is a person dependent on enteral feedings for nutrition. If the enteral nutrition preparation is hyperosmolar (or lacking enough water), the vascular space can become hyperosmolar, moving fluid from the interstitial space. Once the interstitial space is depleted, the vascular space can become hypernatremic. Diabetes insipidus is a diminished production of ADH, commonly seen with some types of head injuries, that can cause increased water loss in the urine and a lack of water retention in the body, also resulting in hypernatremia in the vascular space.

Hypernatremia initially will cause fluid to move from the interstitial space into the intravascular space. This causes congestion and an elevated blood pressure in the intravascular space. Over time, hypertension can cause long-term damage to the vasculature, especially that of the kidneys. Meanwhile, the interstitial space is volume depleted. Therefore, hypernatremia will manifest as dehydration and, at least initially, hypertension. As the kidneys filter out excess water from the vascular system, and lost fluid cannot be replaced, hypernatremia can cause hypovolemia.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety: Providing Adequate Hydration

Disclaimer: Always follow a provider's order for administering enteral fluids.

Definition: Reduce the risk of harm to patients through effective, proficient, and competent performance.

Knowledge: Examine human factors that could lead to water being missed, especially during busy shifts. Understand that patients who rely on others for fluid are at high risk for dehydration, hypernatremia, and possibly hypovolemia. Enterally fed patients may be unable to communicate thirst, especially if their need for enteral nutrition is related to a stroke or other conditions that impair swallowing, communicating, and, possibly, cognitive functioning. Enteral nutrition preparations may or may not have water included with the enteral contents. Some tube feedings are premixed with water and others are not. The nurse must be certain to understand if "free water" needs to be included with enteral feedings, and if free water needs to be added, must be careful that no doses are missed (Figure 19.9). It is easy to overlook the importance of water when a patient is receiving nutrition through a gastric or intestinal tube. Water is not considered a medication and is not "scanned" as a medication but must be administered with the same diligence as a medication. When free water doses are missed, the patient may become dehydrated over time. Dehydration, especially in conjunction with decreased independent movement, and urinary and/or fecal incontinence, can dramatically increase the risk for pressure injuries. If dehydration is not corrected, hypovolemia can cause organ damage and death.

Skill: Administer enteral water in the same manner as enteral medications.

- Review provider's order for the amount and frequency of free-water administration.
- Identify patient using two patient identifiers, per institutional medication administration policy.
- Administer water as ordered by provider.
- Document water administration per institutional requirements.

Attitude: The nurse will respect the importance of water administration and perform as diligently as if water was a medication.

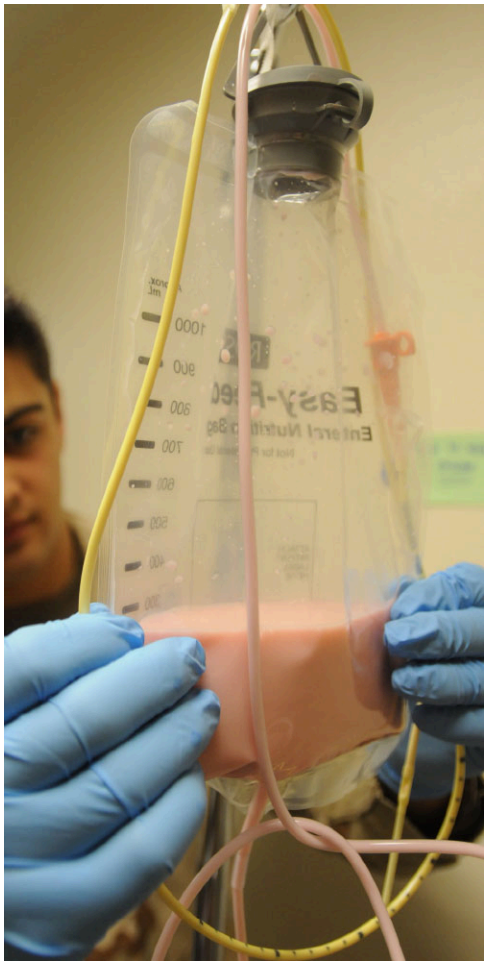

FIGURE 19.9 Nurses must ensure that in addition to the tube feeding solution, all prescribed free water is administered to patients receiving enteral nutrition. (credit: modification of "At Guantanamo 'force feeding' is called 'enteral feeding'" by Joshua Nistas/Wikimedia Commons, Public Domain)

Potassium

As mentioned, the sodium-potassium pump is essential for nerve and muscle cell conduction and contraction. Having discussed the role of sodium, the second element in this ion exchange process is potassium. Most potassium in the body is intracellular. For that reason, serum levels of potassium are much lower than serum levels of sodium. The normal range of serum potassium concentration is 3.7 to 5.1 mEq/L (Cleveland Clinic, 2021).

Potassium is regulated by the kidneys but also moves easily between the intracellular and extracellular spaces. Kidney injury or damage, acid-base imbalances, glucose dysregulation, and some medications can influence serum potassium levels. Because the normal serum level of potassium is low, even slight changes can have a significant impact.

Hypokalemia

A serum potassium level of less than 3.7 mEq/L defines the condition of **hypokalemia**. Potassium-wasting diuretics (loop diuretics and thiazide diuretics) are a common cause of hypokalemia. Other medications cause hypokalemia by activating the sodium-potassium pump at a fast rate. Medications that stimulate the sympathetic nervous system (e.g., beta-2 agonists used for bronchodilation and for other reasons) cause rapid smooth-muscle dilation. This rapid dilation requires energy from the sodium-potassium pump but also depletes extracellular potassium as potassium is exchanged for sodium.

Other common causes of hypokalemia include potassium loss from GI sources, including vomiting, gastric suctioning, and diarrhea. Hyperglycemia like that seen with type 2 diabetes mellitus is another cause of hypokalemia. Insulin secretion activates the sodium-potassium pump to change cell membrane structure and allow

glucose to enter the cell. This sodium-potassium exchange decreases extracellular potassium levels as both potassium and glucose enter peripheral cells. Diabetic ketoacidosis, in particular, can cause hypokalemia when intracellular potassium is exchanged for extracellular hydrogen and then is eliminated in urine as hyperglycemia creates a hyperosmolar intravascular space and fluid moves from the interstitial space into the intravascular space.

Hypokalemia manifests as fatigue and weakness due to a decrease or slowness in the sodium-potassium pump nerve conduction and muscle contraction. This can include a decrease in GI motility, causing nausea and vomiting, peripheral muscle weakness, and slowed conduction creating muscle cramping, cardiac conduction abnormalities causing dysrhythmias, and impaired nerve conduction resulting paresthesia.

Hyperkalemia

The term **hyperkalemia** refers to the condition in which serum potassium level is greater than 5.1 mEq/L. There are three main causes of hyperkalemia. First, kidney injury and disease cause an accumulation of intravascular, extracellular potassium. As mentioned, the serum range for potassium is very narrow, so even small accumulations can cause result in hyperkalemia. Second, potassium movement from the intracellular space to the extracellular space occurs during states of acidosis. When extracellular hydrogen ions are excessive secondary to an acidosis in the body, extracellular hydrogen and intracellular potassium will exchange as a way to protect the body from the acidosis, resulting in hyperkalemia. (Diabetic ketoacidosis can be the exception, as discussed in Hypokalemia). Last, aldosterone insufficiency can cause hyperkalemia. When aldosterone promotes sodium's movement out of the kidney tubules back into the blood, it also causes potassium to move into the kidney tubules for elimination in urine. In the absence of aldosterone, potassium can collect in the serum.

It is estimated that up to 70 percent of clinical decisions are based, at least in part, on laboratory values, and potassium measurement is among the 10 most requested laboratory tests (Khattak et al., 2023). Several factors can contribute to falsely high serum potassium results, termed pseudohyperkalemia. Prolonged tourniquet-application time can damage local tissue cells, and because most potassium is intracellular, cell damage allows intracellular potassium to leak out and become extracellular. Excessive "searching" for a vein can also damage local cells. Using needles that are too small or applying too much negative pressure when drawing blood with a syringe can damage cells. Patients who squeeze their fist too hard can also stimulate potassium release in muscle and that, in turn, can contaminate the blood specimen. For these reasons, it is imperative to correlate laboratory data with clinical assessment findings.

CLINICAL JUDGMENT MEASUREMENT MODEL

Form a Hypothesis: Correlating Laboratory Data to the Patient's Clinical Presentation: Pseudohyperkalemia

The nurse reviews morning laboratory data and discovers the patient's serum potassium level is critically elevated at 7.3 mEq/L. The nurse immediately assesses the patient and determines there are no manifestations of hyperkalemia, the patient is not receiving any medications or IVFs containing potassium, and the patient's potassium level yesterday was within normal limits. The nurse contacts the provider and obtains a new serum blood sample, recognizing that this laboratory test result is not consistent with the patient's clinical presentation and that this may be a case of pseudohyperkalemia.

Hyperkalemia manifests as muscle weakness, slowed heart rate, and even paralysis. The manifestations can be similar to those caused by hypokalemia. Both sodium and potassium are essential for the sodium potassium pump to function adequately. Excess potassium makes it harder for nerve and muscle cells to achieve repolarization and the corresponding resting potential, and so causes more frequent firing. This quickly depletes intracellular sodium levels, and the sodium-potassium pump becomes less functional. The most dangerous result of hyperkalemia may be a slowed heart rate with specific T wave, QRS wave, and PR interval changes that can result in ventricular fibrillation and cardiac arrest.

Calcium

Although people often associate calcium with bone health, calcium also plays a major role in muscle contraction. In all types of muscle, adequate available calcium is necessary to trigger the interaction between actin and myosin. Therefore, calcium regulation is important for cardiac contractility, the dilation and constriction of blood vessels for

blood pressure management, respiratory muscle function, GI muscle contraction, and more. Calcium's role in nerve conduction is multifaceted. It is needed to move electrical signals along axons, and to deposit neurotransmitters into synapsis. Neurologically, calcium is necessary for memory formation (Wood, 2020).

Because calcium is the major component of bone, bone is a source of calcium, if needed. Approximately half of calcium in the serum is in its ionized form, meaning it is a single cation (Ca^{++}) able to bind with calcium cell receptors. However, the other half is not in an ion form but is bound to plasma proteins. Being bound to proteins prohibits this calcium from being able to bind with cell receptors. The normal total serum calcium level in adults is between 8.5 and 10.5 mg/dL (Goyal et al., 2023). Total calcium includes the ionized and bound calcium together. The normal ionized serum calcium range is 4.6 to 5.2 mg/dL, approximately half of the normal total level (Goyal et al., 2023).

Hypocalcemia

A total serum calcium level less than 8.5 mg/dL or an ionized calcium level less than 4.6 mg/dL indicates **hypocalcemia**. During hypocalcemia, the parathyroid gland will release PTH to trigger an increase in GI absorption of dietary calcium in kidney resorption of calcium from the kidney tubules back to the blood. If necessary, it can also stimulate increased osteoclast activity to break apart bone. In healthy people, approximately 98 percent to 99 percent of the calcium filtered through the kidney glomeruli is reabsorbed into the blood (Gallant & Spiegel, 2017). People with chronic kidney disease often have hypocalcemia, but the exact mechanisms that result in this condition are not fully understood. They are suggested to be related to decreased vitamin D absorption in the GI system and decreased calcium reabsorption in the kidney tubules (Gallant & Spiegel, 2017). Other causes of hypocalcemia include:

- alterations in acid-base balance
- hypoparathyroidism
- multiple blood transfusions
- tissue necrosis from pancreatitis

Hypocalcemia causes decreased muscle contraction that results in hypotension, weakness, and fatigue. However, the deficit in nerve cell attachment by calcium ions increases the sodium channels available, leading to rapid nerve cell depolarization and increased nerve excitability. Signs and symptoms of hypocalcemia include:

- cognitive decline
- hyperreflexia
- muscle cramping
- muscle tetany
- numbness and tingling
- seizures

Two simple, noninvasive assessment techniques check for hyperreflexivity and tetany; positive Trousseau sign and Chvostek sign are indicators of hypocalcemia (Figure 19.10).

FIGURE 19.10 Involuntary wrist flexion after the application of a blood pressure cuff inflated to greater than systolic blood pressure is called "Trousseau sign" and is an indication of hypocalcemia. (credit: "Troussau's Sign of Latent Tetany" by "Huckfinne"/Wikipedia, Public Domain)

LINK TO LEARNING

Watch this short video to see a patient with positive Chvostek sign and Trousseau sign (https://openstax.org/r/77trousseau) due to hypocalcemia.

Hypercalcemia

The term **hypercalcemia** refers to a serum calcium level greater than 10.5 mg/dL. Approximately two-thirds of people with hypercalcemia also have hyperparathyroidism. The next most common cause of hypercalcemia is malignancies. In some malignancies, excess PTH is secreted (e.g., breast cancer, squamous-cell lung cancer); in other malignancies, the neoplasm physically invades bony structures and damages bone, which results in release of calcium (e.g., breast, prostate, lung cancers); and in yet others, an excess of vitamin D is present (e.g. pancreatic cancer).

Excess calcium decreases nerve stimulation, which can cause a decrease in cognitive responsiveness, and weak, slowed nerve responses. This slowed nervous system response can result in sluggishness that is manifested in the GI system as constipation, nausea, and possibly vomiting; and in the neurological system as lethargy, confusion, and/or coma. However, the increased calcium can bind with smooth-muscle receptors of the vascular system, resulting in hypertension. If the cause of hypercalcemia is related to increased osteoclast activity from excessive PTH, patients may experience significant bone pain as bone is broken down to release calcium.

LIFE-STAGE CONTEXT

Osteoporosis in Older Women

Research indicates that bone density can decline as much as 20 percent during and after menopause, and that 10 percent of women in those years will experience a bone fracture (Endocrine Society, 2022). Bone loss in osteoporosis is mainly due to declining estrogen levels. Estrogen is necessary to support osteoblast activity that rebuilds bone following the normal bone turnover cycle. As estrogen levels decrease, osteoclast activity remains constant, but osteoblast activity declines.

Additionally, older women who have completed menopause are more likely to experience hyperparathyroidism (American Association of Family Physicians, 2023). As previously discussed, hyperparathyroidism produces an excess of PTH, which stimulates the body to increase serum calcium levels. Recall that one source of additional calcium is calcium stored in bones.

For these reasons, it is important for the nurse to recognize that serum calcium levels are not a good indicator of bone health, especially for older women. In fact, adequate or high serum calcium levels may mean bone is being broken down and not replaced and may indicate poor bone health. Women 65 years of age or older should be encouraged to have a bone density test to accurately detect bone strength.

Magnesium

Normal serum magnesium levels range between 1.7 and 2.2 mg/dL. This is the narrowest range of all the electrolytes. Approximately half (50 to 60 percent) of the magnesium in the body is stored in bones and muscles and nearly all the rest is inside cells of the muscles and soft tissues; less than 1 percent is in the serum. Magnesium is tightly regulated in the body through kidney tubule filtration and small intestine absorption. Magnesium is involved in more than 300 enzymatic reactions that affect, among other things, muscle and nerve function, blood pressure regulation, and immune response (Ware & Hatanaka, 2023).

Hypomagnesemia

Many natural foods are excellent dietary sources of magnesium, but due to the amount of processed food consumed in the United States, many Americans have a dietary deficiency of magnesium. Magnesium deficiency is associated with a host of potential medical conditions, including but not limited to Alzheimer disease, depression, anxiety, headaches, premenstrual syndrome, type 2 diabetes mellitus, osteoporosis, and an array of cardiovascular pathologies (Ware & Hatanaka, 2023). Although **hypomagnesemia**, defined as a serum magnesium level less than 1.7 mg/dL, often results from poor dietary intake, it can also be due to GI digestive and/or absorptive problems, including pancreatitis, significant diarrhea, excess alcohol use, the use proton pump inhibitors for acid reflux, and some gastric bypass surgeries.

As mentioned, hypomagnesemia contributes to any number of disease processes. However, clinically, the nurse will notice manifestation of hypomagnesemia associated with magnesium's influence on blood pressure and heart rhythm, due to magnesium's role in vasodilation and regulation of cardiac rate and rhythm. Hypomagnesemia manifests as hypertension and tachycardia, possibly with serious cardiac dysrhythmias, including torsades de pointes and ventricular fibrillation.

Magnesium is necessary for adenosine triphosphate (ATP) production, which is needed for sodium-potassium pump function. Hypomagnesemia causes the sodium-potassium pump channels to remain open. This prolonged opening can manifest in the nervous system as confusion, hyperreflexia, and positive Chvostek and Trousseau signs, similar to hypocalcemia.

Hypermagnesemia

A level of magnesium that is too high, **hypermagnesemia**, is an uncommon electrolyte imbalance. Magnesium levels significantly greater than 2.2 mg/dL are rare and usually attributed to acute or chronic kidney disease. However, decreased GI motility, as seen in some types of constipation, can cause an increase in magnesium absorption. Coupled with constipation, treatments that contain magnesium such as milk of magnesia or magnesium citrate can cause hypermagnesemia, especially in combination with decreased kidney function.

Acute manifestations of hypermagnesemia typically are not observed until magnesium levels in serum approach greater than 7.0 mg/dL. Hypotension and slowed heart rate with atrioventricular blocks are among the most common and life-threatening manifestations.

Phosphorus

Every cell in the body requires phosphorous to function. Phosphorous, along with calcium, is essential for bone strength. Hydroxyapatite is the mineralized form of calcium phosphate that is present in bone. Phospholipids are major structural components of cell membranes. The process of phosphorylation, whereby phosphate groups are added or removed from proteins, enzymes, and hormones, support cellular functions and supply energy, like ATP. Phosphorous acts as an acid-base buffer through the balance of hydrogen phosphate and dihydrogen phosphate. Diphosphoglycerate, another compound made of phosphorous, directly influences the oxyhemoglobin curve and, thereby, oxygen delivery to tissues.

Phosphorous exists in the body as phosphate; therefore, phosphorous and phosphate are often used interchangeably. Laboratory tests measure phosphate levels; the normal serum phosphate level is between 2.5 and

4.8 mg/dL (Cleveland Clinic, 2021). Like calcium, phosphorus is regulated by PTH and through the kidneys. However, phosphate regulation is the opposite of calcium regulation. When PTH is released, phosphorus levels are decreased through an increase in kidney filtration and excretion. For that reason, alterations in phosphorous levels manifest as the opposite of alterations in calcium levels.

Hypophosphatemia

Hypophosphatemia is usually caused by extreme states of malnutrition from starvation or significant GI malabsorption of nutrients. A serum phosphate level less than 2.5 mg/dL defines **hypophosphatemia**. Because of the phosphorus-calcium inverse relationship, hypophosphatemia manifestations resemble those of hypercalcemia. In severe hypophosphatemia, bone pain can be difficult to manage as osteoclast activity increases to elevate serum calcium levels. The subsequent decrease in nerve function can result in numbness and tingling in the extremities, neuropathies, and possibly coma. Muscle weakness can be life threatening when cardiac and respiratory muscles are affected.

Hyperphosphatemia

Because phosphorus is regulated, in part, by kidney filtration and excretion, most cases of **hyperphosphatemia** (phosphate level >4.8 mg/dL) are related to decreased kidney function. Concurrently, hyperphosphatemia is associated with worsening kidney function due to the formation of calcium phosphate salt calcifications in the vasculature of the kidneys. In a similar manner, cardiovascular disease risk is increased in the patient with hyperphosphatemia (Zhou et al., 2021).

Chloride

Chloride is the most abundant anion in the body. Normal serum chloride levels are 97 to 105 mEq/L (Cleveland Clinic, 2021). Chloride is regulated by the kidneys through filtration, excretion, and resorption in the tubule system. Like sodium, there is much more extracellular chloride than other electrolytes, and like sodium, chloride plays an essential role in fluid balance. As a positively charged ion, sodium (Na^+) moves into and out of the fluid spaces and changes the overall electric charge in the spaces. Chloride moves along with sodium, and because it is a negatively charged anion (Cl^-) it maintains charge neutrality. Additionally, chloride is necessary for acid-base balance because it can move more easily in and out of cells than can bicarbonate ions. Negatively charged chloride can accept a positively charged hydrogen and move intracellularly, thus decreasing blood pH, and vice versa. Last, chloride is a component of a main digestive acid, hydrochloric acid. Hydrochloric acid's acidity helps protect against foodborne illnesses, facilitates nutritional absorption, and stimulates secretion of digestive enzymes and bile from the pancreas and liver.

Hypochloremia

The term **hypochloremia** refers to the condition in which the serum chloride level less than 97 mEq/L. Dilutional causes of hypochloremia include FVE from SIADH or heart failure. Other reasons for hypochloremia are increased kidney losses due to loop and thiazide diuretic therapy; states of acidosis in which, to correct the acidosis, kidney bicarbonate is preserved in exchange for chloride; and lastly, hydrochloric acid loss due to vomiting or nasogastric suctioning. Manifestations of hypochloremia are like those of hyponatremia and can include fluid shifting and weakness.

LIFE-STAGE CONTEXT

Cystic Fibrosis Is No Longer Just a Childhood Disease

Cystic fibrosis (CF) was named in 1955 and is a serious inherited disease in which chloride transport across epithelial cell membranes of the respiratory tract and GI organs is disrupted and so normal fluid transport is interrupted. This results in respiratory mucus that is thick and difficult to clear, and significant malnutrition. Cystic fibrosis used to be a pediatric disease; children diagnosed with CF rarely lived through elementary school age. However, due to treatment advances, approximately 60 percent of patients with CF in the United States today are adults (Cystic Fibrosis Foundation, n.d.).

Hyperchloremia

A serum chloride level higher than 105 mEq/L defines **hyperchloremia**. The most common cause is a loss of

bicarbonate, most frequently seen in extreme or prolonged diarrhea, or from medications that decrease serum bicarbonate levels, such as acetazolamide (Diamox). Manifestations of hyperchloremia are like those of hypernatremia and include hypertension and tissue dehydration.

Homeostatic Mechanisms of Fluid and Electrolyte Balance

As described throughout this chapter, there are many mechanisms that work together to maintain fluid and electrolyte balances in the body. Osmotic regulation relies on osmoreceptors in the hypothalamus and stimulates water movement in response to changes in sodium levels. Antidiuretic hormone is secreted by the pituitary gland when osmoreceptors recognize high sodium levels in the blood. Antidiuretic hormone directs the kidneys to conserve water and thereby lower serum sodium concentrations.

The hormone aldosterone also acts to increase fluid volume, but aldosterone is released on the basis of pressure inside the glomeruli as the last part of the RAAS. Aldosterone acts to increase the amount of sodium returned to the blood. Where sodium goes, water follows; through this mechanism, fluid volume is increased.

Peptides (e.g., atrial natriuretic peptide [ANP]) also assist in fluid volume regulation. ANP is found in the cells of the atrial endocardium. As fluid volume increases, these cells are stretched and release ANP. ANP works by interrupting the RAAS and decreasing fluid volume. Numerous hormones, peptides, and proteins work to maintain electrolyte balances. Through stimulating the digestive system to absorb more or fewer electrolytes, or through altering cell membrane structure to move more or fewer electrolytes inside or outside of cells, the interchange between these mechanisms maintains a balance of fluids and electrolytes.

REAL RN STORIES

A Patient Experienced a Motor Vehicle Accident and Diabetes Insipidus

Nurse: Angel, BSN
Clinical setting: Trauma I hospital surgical intensive care unit
Years in practice: 4
Facility location: A medium-sized city in southern Mississippi

My hospital is the only trauma center within about 150 miles, so we admit a lot of trauma patients from around the area. During a significant rainstorm, I received a patient from the emergency department who required life flight to our hospital following a motorcycle versus automobile accident. The patient was a 25-year-old male named Bruce. When Bruce first got to the surgical intensive care unit, he was experiencing a lot of pain from multiple broken ribs, a large pneumothorax, and an open fracture of his humerus. He was alert and oriented and talking to me about how much he wished he hadn't tried to ride his motorcycle in the rain. He was NPO (not allowed anything by mouth) waiting for surgery to repair his humerus, and we were monitoring him closely for respiratory complications. He had an 18-gauge intravascular access with fluids running at 75 mL/h), an indwelling urinary catheter (IUC), and 2 L of oxygen via a nasal cannula. Compared with other trauma patients, he was easy.

About 4 hours later, I noticed his catheter bag was full of clear, light-yellow urine. I assumed he had received a large amount of IV fluid during life flight and in the emergency room. However, within an hour of emptying his catheter bag, he had another 800 mL, this time of very light-colored urine output. I checked his blood pressure and noted it dropped about 20 mm Hg from his baseline and was now 100/68 mm Hg, with a heart rate of 104 bpm. I was concerned and contacted the admitting physician, who requested a STAT (immediate) urine osmolality measurement and a liter IV bolus of fluid. The urine osmolality returned at 105 mOsm/L, which is very low. By the time I was able to finish the fluid bolus, Bruce had already had a urine output of another 1,200 mL. His neurological assessment had not deteriorated, but the physician ordered a STAT head CT (computed tomography) scan that showed a small subarachnoid bleed. Bruce was immediately sent to the operating room, where a neurosurgeon clipped the bleeding vein. As it turned out, the bleeding was causing inflammation of Bruce's brain that was preventing his pituitary gland from secreting enough ADH and, therefore, his system was making too much urine. Usually, when a patient has a head injury like Bruce did, you observe a change in his level of consciousness, but in this case all I observed was an increase in urine output.

Organs and Body Systems

Of all the body systems, arguably the kidney system has the most important role in fluid volume regulation and electrolyte, as well as acid-base, balance. Injuries and damage to the kidneys can result in a loss of water and electrolyte filtration and elimination. Chronic kidney disease affects more than 37 million people in the United States (National Institutes of Health, 2023). More than 800,000 people in the United States are living with end-stage kidney disease, with 69 percent of people requiring dialysis and 31 percent receiving a kidney transplant (National Institutes of Health, 2023).

Cardiac control of fluid volume is related to ANP, as described earlier; however, the ability of the heart to generate an adequate cardiac output, coupled with the health of the blood vessels throughout the body, is a main consideration in the kidney's stimulation of the RAAS. Fluid volume alterations can affect electrolyte levels through simple dilution or concentration.

The GI system, through absorption, affects both fluid and electrolyte balances. Vomiting and nasogastric suctioning can cause sodium and potassium deficits, and diarrhea can lead to chloride deficits. Some weight loss surgeries can decrease both fluid and electrolyte absorption, as can excessive alcohol use. Excessive or deficient electrolyte intake, through mental health issues like anorexia nervosa or bulimia, lack of adequate food sources due to poverty, or lack of access or even knowledge deficits related to dietary sources of essential nutrients can lead to electrolyte imbalances.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Inserting and Removing a Nasogastric Tube and Irrigating a Nasogastric Tube Connected to Suction

See the competency checklists for Inserting and Removing a Nasogastric Tube & Irrigating a Nasogastric Tube Connected to Suction. You can find the checklists on the Student resources tab of your book page on openstax.org.

Osmosis

Osmosis is the movement of water based on a gradient of solutes to water. Water will move to a fluid space that has the highest solute concentration. This is why normalized levels of the most prevalent solutes—sodium, glucose, and protein—are needed to stabilize fluid movement. Elevated serum glucose or sodium levels will cause a shift of fluid into the vascular system, whereas low serum sodium or protein levels will cause fluid to shift out of the vascular system.

Diffusion

Diffusion is the movement of solutes from an area of high solute concentration to an area of low solute concentration to reach an equilibrium. Diffusion is a passive process, which means it does not require energy. This is crucial to remember when considering compensation of other areas. For example, when potassium is exchanged for hydrogen during an acidosis, each electrolyte diffuses across the cell membrane to balance positive ions. Similarly, when electrolytes are absorbed into the blood from the GI tract, the amount of the electrolyte already present will determine, to some degree, how much new electrolyte can diffuse into the blood.

Active Transport

Most diffusion occurs passively. It is a matter of creating an equilibrium on both sides of a permeable membrane. However, it some cases, diffusion requires energy because the movement goes against an existing gradient. This type of diffusion is called active diffusion or active transport. The sodium-potassium pump is an example of active transport. Most sodium is extracellular, and most potassium is intracellular. The sodium-potassium pump moves sodium out of the cell and potassium into the cell, both against the gradient. This alters the cell's charge and potentiates cell firing, but it requires energy in the form of ATP.

LINK TO LEARNING

Diffusion and osmosis (https://openstax.org/r/77diff-osmo) are passive actions that require a gradient in order to

occur. Unlike passive diffusion and osmosis, ATP (https://openstax.org/r/77Na-Kpump) is required for the sodium-potassium pump to move electrolytes against an existing gradient. This movement changes intracellular ionic charge and stimulates cell firing.

Filtration

Filtration moves both fluids and solutes, either alone or together. Filtration is caused by variations in hydrostatic pressure. The gradient that drives fluid and/or solute movement in filtration is a pressure gradient that exists between two spaces. When hydrostatic pressure is high, fluid and solutes will be forced into a different space. When that occurs, the pressure is changed, and fluids and solutes can move back (Figure 19.11). This is, in part, how fluid, nutrients, and gasses are exchanged between the blood, via capillaries, and the interstitial and intracellular spaces. During cardiac systole, capillary pressure is high, and fluid, nutrients, and gasses are forced out. During diastole, capillary pressure is low, and fluid, wastes, and gasses are forced out of cells and tissues back into the capillaries. Variances in oncotic pressure as fluid, solutes, and gasses move also contribute to filtration.

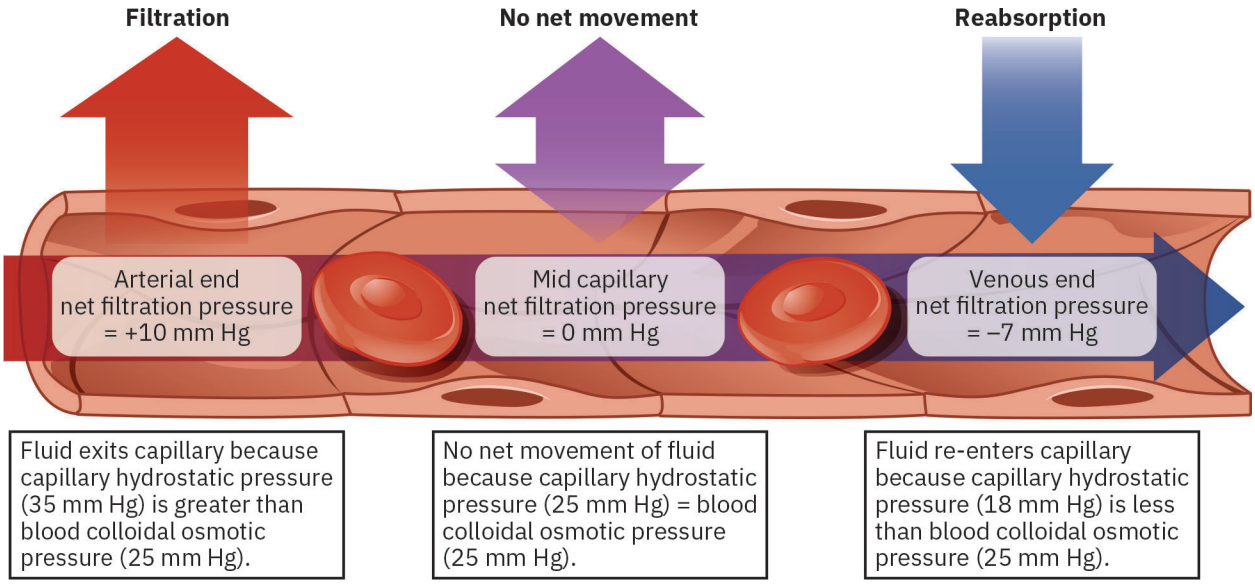

FIGURE 19.11 High arterial hydrostatic pressure forces fluid out of capillaries, whereas lower venous hydrostatic pressure allows fluid to enter capillaries. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

19.2 Nursing Assessment for Fluid and Electrolytes

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Analyze the physical data used in assessment of fluid and electrolyte balances
- Explain the nurse's role in assessment of fluid intake and output
- Recall different laboratory studies used in the assessment of fluid and electrolytes

The nurse is an essential part of the healthcare team. The nurse is the frontline caregiver who is often the first to recognize alterations in a patient's fluid volume status. A thorough assessment provides valuable information about a patient's current fluid, electrolyte, and acid-base balance, as well as risk factors for developing imbalances. Performing a chart review or focused health history is a good place to start collecting data, with any identified gaps or discrepancies verified during the physical assessment. It is also important to consider pertinent life span or cultural considerations that affect a patient's fluid and electrolyte status.

Subjective Assessment

Subjective assessment data comprise information obtained from the patient as a primary source or family members or friends as a secondary source. This information must be obtained by interviewing the patient or someone accompanying the patient. Some of this information can be obtained through a chart review, but it should be verified with the patient or family member for accuracy.

Subjective data to obtain include age; history of chronic disease, surgeries, or traumas; dietary intake; activity level; prescribed medications and compliance with taking medications; pain; and bowel and bladder functioning. Subjective assessment data are helpful to determine normal pattern identification and risk identification. For example, a history of kidney disease or heart failure places the patient at risk for FVE, whereas diuretic use places the patient at risk for FVD and electrolyte and acid-base imbalances. A history of diabetes mellitus also places a patient at risk for fluid, electrolyte, and acid-base imbalances. Recognizing these risks helps nurses be prepared for complications that may arise and allows the nurse to recognize subtle cues as problems develop.

Objective Assessment

The physical assessment experience can elicit anxiety and fear in some patients. Having your body exposed and people touching you may be frightening and unpleasant for many people. The nurse should approach physical assessment with empathy. Introducing yourself and providing privacy are two simple steps to help your patient feel more comfortable. Only exposing one body part at a time and ensuring the patient is warm enough are important as well. The nurse should ask permission before touching the patient and provide an explanation about why this is necessary, making certain to speak to the patient using language that is appropriate for the individual. However, the nurse must be able to complete a thorough assessment and a level of cooperation by the patient is expected.

The following section describes how fluid status and electrolyte status influence the assessment of the skin, mucus membranes, vital signs, neurological function, and weight. Included in the section is information necessary to accurately record a patient's intake and output (I & O) data.

Skin

Because the skin surface is easily accessible, the nurse can use the skin as one assessment indicator of fluid status. To assess the skin, the nurse should touch the patient's skin on the head, torso, and extremities to assess texture and temperature. Ideally, skin should have an even, soft texture and consistent temperature in all areas. The speed with which the skin and its underlying subcutaneous tissue return to their starting position after being lifted is called **skin turgor**. You can assess skin turgor by gently pinching the skin, creating a "tent" shape, then releasing pressure and observing how quickly and completely the skin returns to its normal state. The best place to assess skin turgor on older adult patients is the sternum or antecubital fossa. Skin turgor can be described as any of the following:

- brisk
- elastic
- good
- nonelastic
- poor
- sluggish

Skin texture that feels dry could be an indication of an FVD. However, the nurse should consider other factors that can cause dry skin. Frequently bathing with hot water and soap can diminish the lipid layer of the skin and cause a dry texture. As a person ages, skin can normally lose some softness due to an increase in superficial dead-cell accumulation. In these cases, dryness may not be an indicator of volume deficiency. Additionally, the lips should be smooth and supple, without dryness, chapping, or cracking. Skin temperature should be consistent and warm. Generalized coolness can suggest hypovolemia; however, localized coolness is more likely related to arterial health.

LIFE-STAGE CONTEXT

Skin Turgor Assessment in Older Adults and in Children

When turgor is assessed in older adult patients, the skin should be assessed on the anterior chest just under the clavicle—not the back of the hand. Because of degenerative age-related changes, including the loss of subcutaneous tissue and a reduction in the epidermal thickness of skin, skin turgor of the hand does not provide an accurate assessment of the older adult patient. In fact, some sources suggest even the chest wall skin turgor assessment may not accurately reflect fluid volume status in older patients (Jour et al., 2019). Also, it is recommended that when assessing skin turgor in children, skin on the abdomen, specifically the lateral abdominal wall near the umbilicus, be used instead of the back of the hand (Scott, 2024).

Mucous Membranes

Like a skin assessment, a mucous membrane assessment may elicit information about the fluid volume status of a patient. Mucous membranes are located throughout the body, generally where the body interacts with the outside environment. A mucous membrane is a thin layer of cells that covers a surface and secretes mucous. The surfaces that are easily accessible for a nurse to assess include the nares, gums, and tongue.

The nurse should assess the nares using a flashlight. The nares should be intact without evidence of cracks or bleeding. The nurse assesses the mouth by asking the patient to open their mouth. A penlight can assist the nurse to examine the structures of the mouth. The gums, regardless of the general skin tone of a patient should appear pink or light pink. Pale mucous membranes may be a sign of decreased perfusion, which can be a complication of decreased vascular volume. In individuals with dark skin, decreased mucous membrane perfusion may result in an ash-gray color (Pusey-Reid et al., 2022). The gums should be moist. The tongue, regardless of the skin tone of the patient, should be red or pink and moist. Saliva plays a crucial role in the health of the mouth and its components. If saliva is decreased due to an FVD, the patient may have bad breath, sticky or dry gums or tongue, and fissures may be present.

Vital Signs

Vital signs are an objective assessment of fluid volume status. Vital signs, specifically blood pressure and heart rate, reflect the degree of FVD or FVE. Hypervolemia manifests as high blood pressure (hypertension), the addition of a third heart sound (S3), bounding peripheral pulses, and visible jugular veins when the patient is sitting at a 45° angle or greater. See Chapter 24 Assessment of the Cardiovascular and Peripheral Vascular System for more about components of cardiac output when considering the fluid volume status of a patient.

As fluid volume increases, blood pressure may increase. However, the body space that excess fluid occupies determines whether the excess fluid remains in the vascular space, causing an elevated blood pressure, or is housed in the interstitial spaces, causing edema.

Blood pressure may or may not be altered with fluid balance alterations. The degree to which the body can compensate by increasing heart rate and by altering the degree of vasoconstriction or dilation will determine how blood pressure or heart rate are affected.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Determining the Cause of Tachycardia

The nurse is assessing the patient's fluid volume status. The nurse assesses the patient's vital signs and obtains the following results:

Blood pressure	142/82 mm Hg
Apical heart rate	112 bpm
Respiratory rate	20 bpm
Oral temperature	99.0°F
Oxygen saturation (Spo_2) on room air	99 percent

The nurse recognizes the patient's heart rate and blood pressure are elevated. The nurse first gathers more data by reviewing the patient's chart to assess blood pressure and heart rate trends over the past several days. The nurse notes that the patient's heart rate was in the 70 to 80 bpm range since admission and only recently elevated.

The nurse considers why a patient's heart rate may be elevated. Possibilities include anxiety, pain, infection, or volume deficit. The nurse continues to gather more data. The nurse interviews the patient, who states they are

feeling fine, is calm, and is not in any pain. The nurse reviews recent laboratory test values, including a complete blood cell count, and finds a normal white blood cell count of 6,700/μL but an increased hematocrit level of 50 percent. The nurse recognizes the clues are suggesting a fluid balance deficit. The nurse reviews the past several days' I & O records and determines the patient had been NPO yesterday for an endoscopy and the fluid balance is −1,200 mL. The nurse encourages the patient to drink extra fluid, thereby averting a greater FVD well before blood pressure and organ perfusion are affected.

A subset of vital signs useful in the assessment of fluid status is termed **postural vital signs**, commonly also referred to as **orthostatic vital signs**. To measure orthostatic vital signs, the nurse will assess a patient's blood pressure and heart rate when lying supine, and then immediately upon sitting upright or standing. Ideally, the patient will be supine for at least 5 minutes, then sit or stand. A blood pressure difference of −20 mm Hg systolic or −10 mm Hg diastolic between the supine and sitting/standing reading is considered orthostatic hypotension. Observe for symptoms: Ask the patient if they feel dizzy, lightheaded, or have any other symptoms upon standing. Monitor them closely for signs of orthostatic intolerance, such as pallor, sweating, nausea, or changes in level of consciousness.

Although there are several potential causes for this drop in blood pressure, hypovolemia is a common cause. The nurse, in collaboration with providers, would need to rule out other causes, such as fever, prolonged bed rest, medication reactions, or autonomic nervous system compromise, but should consider FVD as a possible cause. As the patient becomes upright, gravity shifts fluid to the trunk and lower extremities. If volume is not adequate, blood pressure decreases and heart rate elevates. The nurse must be certain to address patient safety during this evaluation because decreased cerebral perfusion can lead to dizziness and falls (Ringer & Lappin, 2023).

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Preventing Patient Falls

The nurse is requested to assess for orthostatic blood pressure changes in a patient. The nurse understands that if orthostatic changes are present, blood may too quickly pool in the lower extremities and venous system of the GI tract and as a result, the patient is at risk for falls due to dizziness.

To decrease the risk of a patient falling while obtaining orthostatic vital signs, the nurse will make sure all equipment is in the room. The nurse will coordinate to have another healthcare provider in the room if the patient will be standing up. If the patient is standing up, nonslip socks are provided. The nurse makes certain the area is free from objects that could injure the patient if they were to fall.

The nurse will explain the procedure to the patient and stress that although this assessment requires the patient to change positions as requested, normally, the patient should change positions slowly.

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 10

Refer back to Unfolding Case Study #3: Part 9 to review the patient data.

Flow Chart	**2130:** Blood pressure: 152/85 mm Hg Heart rate: 121 bpm Respiratory rate: 28 breaths/minute Temperature: 99.6 °F (37.5°C) Oxygen saturation: 93 percent on 2 L nasal cannula Pain: 3/10 with breathing
Provider's Orders	**2140:** Supplemental oxygen to maintain oxygen saturation >92 percent Insert peripheral intravascular access Furosemide 20 mg IV × 1 dose Monitor and document accurate I & O information

3. Prioritize hypotheses: On the basis of the patient's vital signs, describe what is happening in the patient's body related to cardiac output and preload.
4. Generate solutions: What is the rationale for administering furosemide to the patient? How will this medication affect preload?

Neurologic Assessment

The neurological system is sensitive to fluid volume changes. If cardiac output is low due to a low stroke volume, the amount of blood delivered to the brain tissue will be decreased. Decreased brain tissue perfusion results in decreased oxygen delivery to brain tissue, and brain tissue, including neurons, will have decreased function. This decreased function may be witnessed during a nurse's assessment as a decrease in cognitive and/or motor abilities. Additionally, when a volume deficit is present, brain tissue can shrink. Brain tissue shrinkage will affect cellular function but may also cause tissue to pull away from the sites of attachment to the skull, causing inflammation and bleeding.

Fluid volume excesses may be equally concerning to neurological function. As cerebral tissue expands due to cerebral edema from hydrostatic pressure increase, capillary permeability changes, or osmotic disturbances (refer to Fluid Volume Excess), brain cells and neurons are compacted, and cerebral perfusion is decreased due to compression of the cerebral vasculature. Neuronal and cellular ischemia results in dysfunction, which is manifested as cognitive and motor skill decline. The nurse should perform a full neurological assessment.

PATIENT CONVERSATIONS

Completing an Assessment of Orientation

Scenario: Nurse walks into the patient's room to perform an assessment of the patient's level of orientation as part of a full neurological assessment, which is indicated whenever fluid volume or electrolyte level abnormalities exist or may potentially exist.

Nurse: Good morning. My name is Kameron and I am going to be your nurse today. Can you tell me your name and date of birth, please?

Patient: Yes, I sure can. [Patient says this jokingly.]

Nurse: [Laughs a little] I understand this may seem strange, but I need you to tell me to properly identify you.

Patient: Ted Richardson, April 8, 1943.

Nurse: Thank you, Mr. Richardson. I just have a few more questions. Do you know where you are?

Patient: I'm in the hospital.

Nurse: Can you tell me which hospital you are in?

Patient: I am at City General Hospital in Bay City, Rhode Island.

Nurse: I appreciate that, Mr. Richardson. Last question: Why are you here today?

Patient: I was feeling dizzy a lot at home. Dr. Atkins wanted me to come to the hospital for some tests. We were both concerned I could fall at home.

Nurse: Thank you again, Mr. Richardson. I know patients can get tired of answering the same questions over and over, but it's important that we continually ask them so we can tell if anything is changing. I appreciate your patience.

Fluid Intake and Output Assessment

The nurse must closely monitor a patient's I & O to determine if a fluid balance alteration is developing, preferably before major manifestations occur. In most cases, the **fluid balance** is totaled at the end of each shift. In critical care areas, I & O may need to be monitored hourly. Follow individual facility protocols to determine how often a fluid balance should be recorded. The fluid balance is the difference between how much fluid is taken in and how much fluid is lost. A positive fluid balance means more fluid has been taken in than lost, whereas a negative fluid balance indicates more fluid is being eliminated than taken in.

Intake

Fluid intake includes oral fluid intake. Fluids included as intake are from any food item that is liquid at room temperature or of which fluid is the main ingredient. Examples include many dairy-based foods like custards, yogurts, ice cream, pudding, and gravy. Soups and broth are considered oral intake. Frozen water-based foods such as ice chips and popsicles are also considered intake but are counted as half their volume. High-water-content fruit like watermelon or cantaloupe are also considered fluid intake and count as half their volume.

Other sources of intake include enteral feedings of prepared nutrition as well as free-water supplementation delivered into an enteric tube such as a nasogastric tube or gastric tube. Intravenous (IV) fluids are also considered intake and include maintenance fluids, parenteral nutrition, and fluid associated with medication administration such as continuous IV drips and intermittent medications such as antibiotics and IV flushes. Lastly, it is important to consider any type of irrigation as input. For example, if the nurse completes an indwelling bladder catheter irrigation using 60 mL of sterile water, the nurse must include this as input because it will be returned as urine output.

Output

The nurse must closely monitor a patient's total output. Output includes urine, either freely voided or from an indwelling urinary catheter (IUC), urinary diversion, or nephrostomy. Other sources of output may include liquid stool, gastric secretions, emesis, any type of drain a patient has (regardless of what type of fluid the drain contains), blood, serous fluid, biliary fluid, and so forth. Sweat is not measurable and is not recorded as output, although significant sweating should be reported to the provider for consideration. In the event a patient is incontinent of urine or liquid stool, the nurse should document each occurrence.

PATIENT CONVERSATIONS

Discussing Sensitive Bodily Functions with Patients

Scenario: The nurse is caring for a patient experiencing frequent liquid diarrhea and needs to record an accurate I & O. The nurse gathers a urinal and a toilet hat for the patient.

Nurse: Hello, Mr. Williams, my name is Abena and I am going to be your nurse today. I have brought you a urinal and a collection hat. The urinal is to collect and measure your urine, and the hat will go into the commode so I can measure how much diarrhea you are having.

Patient: Oh, that must be an awful job. I am so sorry you must do that. Can't I just tell you how much I have gone? I am embarrassed to have to save my stool.

Nurse: I understand you are uncomfortable saving your stool for me to measure. Using the bathroom is a private experience. Let me reassure you that the most important thing for me is to accurately measure how much liquid you are losing. I don't want you to get dehydrated. I will do my best to empty your hat as soon as possible, so please let me know when you have used it.

It is essential that the nurse performs timely documentation of the patient's I & O (Table 19.4). Often, accurate I & O recordings can predict an FVD or excess before manifestations appear, allowing providers to intervene early.

Time of Day	Intake (mL)			Output (mL)		
	Oral	Enteral	Parenteral	Urine	Drains/Tubes	Other
0700–0800	500		75			
0800–0900			75	400		
0900–1000			75			
1000–1100			75			
1100–1200			75	350		
1200–1300	240		125			
1300–1400			75			
1400–1500			75	425	75	
8-hour total	740	0	650	1,175	75	
8-hour intake	1,390					
8-hour output				1,250		
Balance of 8-hour intake and output: −140 mL						

TABLE 19.4 Sample Intake and Output Documentation All sources of fluid intake and all sources of fluid output should be recorded. Totals should be calculated every 8 hours and for every 24 hours, or according to facility policy.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Assisting with the Use of a Bedpan and a Urinal

See the competency checklists for Assisting with the Use of a Bedpan & Assisting with the Use of a Urinal. You can find the checklists on the Student resources tab of your book page on openstax.org.

In addition to measuring the quantity of urine output, the nurse should also consider characteristics of the urine. As fluid volume decreases, urine becomes more concentrated and appears a darker yellow or brown. "Straw-colored' urine is a common term to describe dark yellow urine, and "tea" colored urine is a common description of concentrated urine that is brown.

Daily Weight

An easy and inexpensive method to monitor a patient's fluid volume status is by weighing the patient. Additionally, a

patient's weight may be used to determine the amount of medication to administer to a patient. Although weighing a patient is a simple task and often is delegated to an unlicensed assistant, the nurse must be certain that several factors are considered. Documenting how a patient is weighed upon initial assessment is crucial to using weight as an ongoing assessment indicator. The nurse should note on what scale the patient was weighed, what time of day the patient was weighed, and what clothing and footwear the patient was wearing at the time the weight was taken and documented. For consecutive weight comparison, the patient should be weighed at the same time, with the same scale, and wearing the same amount of clothing or bedding.

In hospitals and care facilities, often a sling-type scale or a bed scale is used. If a sling-type scale or a bed scale is used, it is essential that the nurse ensure the number of linens, including pillows, are consistent when the patient is weighed. In institutions, the sling-type scale or bed scale can be zeroed. "Zeroing" a scale is done before the patient is in the bed and is done by placing appropriate linens and pillows on the scale or bed, then electing this weight as zero. Typically, linens will include a bottom sheet, draw sheet, top sheet, comforter, pillow, pillowcase, and a pillow. Once the patient is placed in the sling or on the bed, the weight will not include the linens or pillows, and will be an accurate reflection of the patient's weight. Any subsequent weights performed must have the same number of linens and pillows. Thus, any change in weight can be attributed to the patient, not to changes in the number of linens. Additionally, the nurse must be certain that drains and catheter bags are empty and held by a bystander so those are not included in the patient's weight. If the drains are not held by a bystander and are hanging off the bed or held by the patient, their weight will be included in the patient's weight and will result in an inaccurate measurement of the patient's weight.

LINK TO LEARNING

Nurses can assess patient weight easily with built-in bed scales. Watch this video to see how to weigh a patient (https://openstax.org/r/77weighpat) on a hospital bed.

Significant unexplained weight changes may be the result of fluid loss or retention. One liter of water weighs approximately 1 kilogram (kg), or approximately 2.2 pounds. Therefore, accurate daily monitoring of weight can suggest changes in a patient's fluid balance. Although this is a simple, inexpensive, and unobtrusive means to monitor fluid balance, the nurse is challenged to obtain an accurate patient weight. Detailed documentation and consistent replication of the how the baseline weight was measured is necessary.

REAL RN STORIES

Weight-Based Heparin

Nurse: Paula, RN
Clinical setting: Emergency department (ED)
Years in practice: 1
Facility location: Large teaching hospital in Denver, Colorado

I work in the ED of our level I trauma hospital. On the nightshift over Thanksgiving weekend, a father and son pair of duck hunters was reported missing and, after a nearly 16-hour search, they were located. The father had fallen down a steep embankment and his son was scared to leave him to try to find help. The father arrived by ambulance to our ED.

The father sustained multiple injuries and was already experiencing symptoms consistent with disseminated intravascular coagulation upon arrival to the ED. Once settled in the bed, I started gathering supplies to start a stat continuous heparin infusion. Almost immediately I realized I could not obtain a weight for the patient because the bed had not been zeroed. Unit policy dictates that all empty beds be ready with fresh linens and zeroed; however, in this case that did not occur.

Because heparin is a weight-based medication and an accurate weight is crucial to safely dosing this medication, I had no choice but to transfer the patient to another bed that had been properly zeroed. Not only did this additional

move cause the patient pain, it also delayed the start of the heparin drip by nearly 30 minutes.

I felt frustrated about what happened and discussed it with my manager the next morning. My manager told me that I was correct in my understanding that whoever had made the bed should have zeroed it and that the patient shouldn't have had to experience that additional pain and delay. However, she suggested that the best thing to do is to always double check. We are all human, and we all make mistakes. I will always double check my bed first thing.

Laboratory Studies Assessment

Diagnostic tests and laboratory tests provide important information about fluid status, electrolyte status, and acid-base balance and should be used in conjunction with a thorough subjective and objective assessment to form a complete picture of the patient's overall status. This will help ensure correct information is reported to the provider as necessary. There are several laboratory test results that are useful for identifying fluid volume changes in patients. Hematocrit, serum osmolarity, and BUN and creatinine levels can contribute to the interpretation of a patient's fluid volume status.

Hematocrit

Hematocrit (HCT) is a blood test that measures how much of your blood is made up of red blood cells compared with the liquid component of blood, called plasma. The HCT is often part of a complete blood cell count (CBC), a routine test that measures different components of your blood. The normal HCT for men is 42 percent to 52 percent; for women, it is 37 percent to 47 percent, however, these ranges may vary slightly across laboratories.

In addition to measuring red blood cells, HCT levels can also be used to evaluate fluid balance. When there is a FVD, the plasma component of the blood also decreases, causing an elevated concentration of red blood cells (and an elevated HCT). In this case, drinking more fluid or receiving IVFs will bring the HCT level back to normal range. Conversely, if a patient is experiencing FVE, the plasma component of the blood is increased, causing dilution of the red blood cells and a decreased HCT level (Figure 19.12).

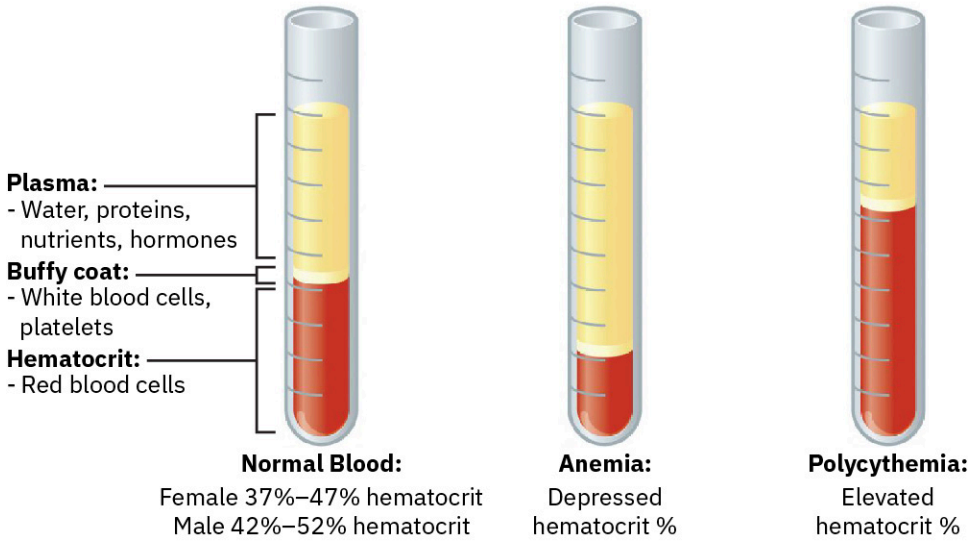

FIGURE 19.12 A normal HCT, decreased HCT, and an increased HCT contain variations in plasma levels. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Blood Urea Nitrogen and Creatinine

Blood urea nitrogen measures the amount of urea nitrogen in your blood. Blood urea nitrogen and serum creatinine levels are used to evaluate kidney function, with increased levels indicating worsening kidney function. In general, the normal BUN range is 10 to 20 mg/dL, but normal ranges vary depending on the reference range used by the laboratory and the patient's age. Patients with deficient fluid volume can also have elevated BUN levels for the same reason that HCT is affected: as plasma levels decrease, the blood becomes more concentrated.

These two laboratory values are used together to determine how well a patient's kidneys are working, but in some cases can also be used as an indicator of blood water volume. This comparison is called a **BUN to creatinine ratio**. A

normal BUN to creatinine ratio is around 20:1. Since creatinine is supposed to be mostly eliminated, creatinine is a good indicator of how well the kidneys are working to eliminate waste. If creatinine is increased, and BUN is increased, it is usually because the kidneys are not working optimally. However, because the majority of BUN is not eliminated but is instead reabsorbed into the blood, when it is increased and creatinine is normal, it often means the fluid volume in the vascular space is decreased (Table 19.5).

Laboratory Test	Normal Serum Level	Example of a High Level	Example of a Consistent or Low Level
BUN, mg/dL	10–20	30	8
Creatinine, mg/dL	0.7–1.2	2.0	0.5
BUN to creatinine ratio	20:1	30:1	15:1
Possible cause		Low water volume	Poor kidney function

TABLE 19.5 Using BUN and Creatinine to Interpret Fluid Volume Status

Serum Osmolarity

Serum osmolarity (often interchanged with the term serum osmolality) measures the concentration of particles in the blood with a normal range of 275 to 295 mmol/kg. Normal value ranges may vary slightly among different laboratories. In healthy people, when serum osmolality in the blood becomes high, the body releases ADH. This hormone causes the kidneys to reabsorb water, resulting in dilution of the blood and the return of serum osmolarity to normal range. An elevated serum osmolarity level means the blood is more concentrated than normal and often indicates deficient FVD. A decreased serum osmolarity means the blood is more dilute than normal and may indicate an FVE.

Urine Laboratory Data

Urine osmolarity measures the concentration of particles in the urine. An increased urine osmolarity result means the urine is concentrated and can indicate FVD. A decreased urine osmolarity result means the urine is dilute and can indicate excess fluid intake. A type of urine test for **urine specific gravity** measures hydration status by measuring the concentration of particles in urine. Normal urine specific gravity levels are between 1.010 and 1.020. A urine specific gravity above 1.020 indicates concentrated urine and can indicate an FVD, similar to an elevated urine osmolarity. A urine specific gravity below 1.010 indicates dilute urine, which can occur with excessive fluid intake.

When excessive fluid volume occurs, altered physiological mechanisms affect the kidney's ability to increase urine output to eliminate excessive fluid volume, causing urine output to decrease. As a result, the serum osmolarity decreases as fluid is retained, but the urine specific gravity is elevated because urine is concentrated.

19.3 Considerations for Fluid and Electrolyte Imbalances

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Examine how modifications to fluid intake maintain balance
- Recognize how administering medications maintains balance
- Recall and utilize patient education for self-management of fluid and electrolyte balance

When patients experience body systems that are unable to maintain fluid and electrolyte balance, the patient may need to modify what they consume. Modifications can be made in fluid intake or in the number of electrolytes consumed. Patients may need the assistance of the nurse to help them identify what foods and beverages should be

avoided and what alternatives are available. When providing education about diets, the nurse can consult a dietitian for guidance as needed. As a general rule, the nurse is assisting the patient to choose and/or limit foods and or beverages in support of a diet that has already been prescribed by a dietitian or provider.

Modifying Fluids and Electrolytes

Patients experiencing diseases that alter fluid and/or electrolyte levels may need to adjust their oral fluid intake and dietary choices. The nurse's role is to provide education and encouragement to patients who need to make these lifestyle changes. Education will focus on what which foods are considered liquid and which liquids are best, depending on the goals for fluid modification.

Similarly, the nurse will assist the patient to make the best food choices to increase or decrease specific electrolytes. Educating patients on how to read nutrition information is key to assist patients in making correct food choices. The nurse should remind patients that the only way to know how much of a substance is in food is to look at the nutrition label or read about the food from a reliable source. This advice includes food seasonings, some of which can contain hidden electrolytes.

Increasing Fluids

The patient may be encouraged to increase oral fluid intake during times of active fluid loss, such as occurs with diarrhea, or to regain fluid lost from illness. In the healthcare setting and in some home care settings, IVFs are an option. However, as will be discussed in Administering Intravenous Fluid, IVFs can have complications and should be avoided unless necessary. Long periods without liquids and food entering the GI system can result in atrophy of the intestinal muscles and decreased GI function. For these reasons, oral fluid and electrolyte replacement is preferred if the clinical situation supports oral replacement.

The nurse should understand the goals of fluid replacement. If water needs to be replaced, the nurse will encourage the patient to drink water. Beverages with sugar, such as juices, sports drinks and sodas, can add to interstitial dehydration by filling the vascular system with glucose, which will then draw water from the interstitial space into the vascular system. Low-calorie beverages may be a better choice, but they commonly contain artificial sweeteners that, in some cases, also increase blood glucose levels. In most cases where rehydration is the goal, water is the best choice. The nurse should ensure patients have fresh water available at all times and monitor fluid intake.

Fluid Restrictions

During existing FVE, or to prevent FVE in patients at high risk for it, such as in patients experiencing decreased kidney or cardiac function, providers may limit the amount of fluid a patient receives. If the goal is simply to limit fluid intake, the nurse must educate the patient as to what is included as fluid. As discussed earlier, there are special considerations for things like cream-based soups and puddings, as well as frozen liquids. The nurse must educate the patient about the prescribed daily fluid intake and may need to help the patient divide a 24-hour limit by how much should be consumed with each meal and snack.

The nurse must also understand that patients with diseases that affect the cardiac, kidney, and liver systems, especially, may have other restrictions that will influence fluid choices. For example, patients with kidney disease may need to avoid foods high in sodium and potassium. Vegetable juices and some fruit juices are high in sodium and potassium, so even if the amount is within the prescribed limit, the patient should be encouraged to make a different choice.

REAL RN STORIES

Patient Teaching Related to Fluid Restriction

Nurse: Jasmine, BSN
Clinical setting: Case manager for home health care
Years in practice: 11
Facility location: A small rural community outside Nashville, Tennessee

I had been a nurse for over a decade when I transitioned into home health care. One of my first patients was a man named Richard. Richard had been discharged from a local hospital following an acute coronary event diagnosed as

unstable angina secondary to early-stage, left-sided heart failure. Richard also had a diagnosis of type 2 diabetes mellitus. He was smart and motivated; he wanted to avoid a heart attack. He was focused on eating healthy and exercising. Richard was assigned a home health nurse for two visits per week for 2 weeks to assess how he was doing on his new diuretic therapy. In addition to the usual fluid volume assessment indicators, I wanted to see how Richard was managing his new fluid intake restriction of 1,500 mL per day.

On my first visit, Richard seemed to be doing fine. He verbalized an understanding of how to weigh himself every morning at the same time, on the same scale, with the same amount of clothing; how to consider how his rings, socks, and shoes were fitting; and whether he was able to participate in his typical daily activities without dyspnea or chest pain. He understood his fluid restriction and wrote down any fluids he consumed during the day. However, when I went back 3 days later, Richard reported he was having a bad day. His weight hadn't changed in the morning, but by late afternoon when I visited, he was feeling some dyspnea and felt tired. Although his vital signs were within his normal range, he did look somewhat short of breath. I asked Richard if he had done anything different today than during the days since he was discharged from the hospital. Richard told me that he had had a fun morning because his daughter had taken him to the local farmers' market where he picked up a new houseplant and some fresh fruit, including a watermelon. After he got home from shopping, he just watched TV and ate half of his watermelon. We talked some more and together we determined that he most likely took in more fluid than he should have for the entire day because he didn't account for the watermelon being included as fluid intake. Additionally, we discussed how much sugar is in fruit and how that extra sugar likely increased his blood glucose level, making him retain water more than usual. We discussed the importance of considering serving size and what foods contain a high amount of fluid. I also called his provider and obtained an order to see Richard the next day for an extra visit. The next day he was doing better. He never needed an extra dose of diuretic and had no permanent complications from his watermelon overload. I discharged Richard at the end of the next week on time because he was doing excellent managing his new cardiac regimen.

Administering Medications

Medications may be ordered to correct fluid and electrolyte levels. It is important that the nurse monitor the patient's physical and laboratory data before and after administering medications that alter fluid and electrolyte levels to ensure the medications are safe to administer and have satisfied any deficit or maintenance requirement. Common medications administered to treat fluid and electrolyte imbalance include mineral-electrolyte preparations, diuretics, and IVFs.

Mineral-Electrolyte Preparations

At times, through dietary deficiencies, excessive loss from GI or kidney dysfunction or illness, or due to various metabolic abnormalities, patients may experience a decreased level of serum electrolytes. Electrolytes are minerals that have an ionic charge; they include sodium, potassium, calcium, magnesium, phosphorous, and chloride.

The method of electrolyte administration will depend on the patient's ability to take oral medications and the severity of the deficit. When deficits are mild and manifestations are not life threatening, oral supplementation is adequate (Table 19.6).

Electrolyte	Level	Example Medication(s)	Mechanism of Action	Nursing Implications
Na^+ (sodium)	<136 mEq/L = hyponatremia	Sodium chloride (NaCl): "salt tablets" IVF: 0.9 percent NaCl to 3 percent NaCl Conivaptin (Vaprisol)	Directly supplements sodium and chloride through GI absorption. Directly supplements sodium and chloride through intravascular administration. Inhibits the release of ADH to correct or prevent dilutional hyponatremia	Monitor serum sodium levels. Use cautiously in patients with kidney disease. Thoroughly assess for fluid shifts, tissue dehydration, hypervolemia. Monitor for manifestations of hypernatremia.
	>144 mEq/L = hypernatremia	IVF: 0.45 percent NaCl or 5 percent dextrose in water (D_5W) Vasopressin (e.g., Vasostrict)	Replenishes water without adding extra sodium. Synthetic ADH; used specifically for the treatment of diabetes insipidus	Monitor serum sodium levels. Use cautiously in patients with kidney disease. Thoroughly assess for fluid shifts; peripheral, pulmonary, and cerebral edema. Monitor for manifestations of hypernatremia.
K^+ (potassium)	<3.7 mEq/L = hypokalemia	Potassium chloride (e.g., Klor, K-Lyte)	Directly increases serum potassium levels via oral or parenteral routes	Monitor serum potassium and creatinine levels. IV potassium should not exceed 10 mEq/h. IV potassium may cause burning when administered in peripheral veins.
	> 5.1 mEq/L = hyperkalemia	Sodium polystyrene sulfonate (e.g., Kayexalate)	Decreases serum potassium by facilitating the exchange of Na^+ and K^+ in intestinal cells and increasing fecal excretion	Monitor serum potassium levels. Educate the patient that this medication will cause diarrhea. Monitor for coinciding FVD.

TABLE 19.6 Common Examples of Medications to Treat Electrolyte Alterations

Electrolyte	Level	Example Medication(s)	Mechanism of Action	Nursing Implications
Ca^{++} (calcium)	<8.5 mg/dL = hypocalcemia	Calcium carbonate (oyster shell calcium) Calcitriol (Rocaltrol)	Calcium supplement Vitamin D_3 to increase GI calcium absorption	Monitor serum calcium and phosphate levels.
	>10.5 mg/dL = hypercalcemia	Alendronate (e.g., Fosamax)	A bisphosphonate that decreases bone breakdown. Stops calcium from being taken from bones in hyperparathyroidism and slows the progression of osteoporosis	There are numerous oral and IV bisphosphonates available in the United States. Some are taken daily, whereas others are taken weekly, monthly, or yearly. Educate the patient about the correct frequency.
Mg^{+} (magnesium)	<1.7 mg/dL = hypomagnesemia	Magnesium citrate Magnesium sulfate	Oral magnesium supplement for prevention or treatment of mild hypomagnesemia IV magnesium supplement for severe hypomagnesemia	Monitor serum magnesium levels.
	>2.2 mg/dL = hypermagnesemia	IV calcium gluconate	IV calcium supplement that decreases the manifestations of hypermagnesemia by competing for cell receptors	Monitor serum magnesium and calcium levels. The rate of administration of calcium gluconate is based on the severity of hypermagnesemia.
P^{+}/PO_4 (phosphorus/ phosphate)	<2.5 mg/dL = hypophosphatemia	IV sodium phosphate or potassium phosphate	IV supplements for hypophosphatemia; the selection will depend on sodium and potassium levels	Monitor serum phosphate and calcium levels. Most oral supplements cause GI upset.

TABLE 19.6 Common Examples of Medications to Treat Electrolyte Alterations

Electrolyte	Level	Example Medication(s)	Mechanism of Action	Nursing Implications
	>4.8 mg/dL = hyperphosphatemia	Calcium carbonate (e.g., Caltrate)	Calcium binds with phosphate and decrease GI phosphate absorption while increasing urinary excretion.	Monitor serum phosphate and calcium levels.
Cl^- (chloride)	<97 mEq/L = hypochloremia	IVF: 0.9 percent NaCl	As low levels are usually related to fluid loss; rehydration is with IVF that contains Cl^-.	Monitor fluid volume status for manifestations of FVE.
	>105 mEq/L = hyperchloremia	IVF: D_5W Sodium bicarbonate	IVF without Cl^- to dilute hyperchloremia Hyperchloremia-induced acidosis can be neutralized with the administration of a base.	Monitor serum sodium and chloride levels. Monitor for the development of metabolic alkalosis manifestations.

TABLE 19.6 Common Examples of Medications to Treat Electrolyte Alterations

When a patient is not able to take oral medications, or when the need to replace depleted electrolytes is more urgent, IV solutions may be prescribed. As with any IV medication, it is important for the nurse to know the safe rate of administration. Too rapid administration of electrolytes can cause a sudden excess of extracellular electrolytes, which can be dangerous. For this reason, IV electrolytes are always administered using an IV pump.

CLINICAL JUDGMENT MEASUREMENT MODEL

Generate Solutions: Managing IV Potassium When It Hurts

The nurse is requested to administer three doses of IV potassium chloride to a patient with an 18 gauge peripheral intravascular access. The nurse prepares the IV solution of 10 mEq KCl mixed in 100 mL of 0.9 percent NaCl and begins the infusion. Almost immediately the patient tells the nurse he is experiencing a burning sensation. The nurse knows potassium can be irritating to peripheral veins. The nurse considers the options: slowing the IV rate until it doesn't hurt the patient, or diluting the potassium until it doesn't hurt the patient. The nurse shared her concerns with the provider, who agreed to order an additional IV infusion of 0.9 percent NaCl to which the infusing potassium will be piggybacked, to dilute the infusion.

At change-of-shift report, the nurse explained, "Mr. Shearer's potassium was only 3.1 so I didn't want to slow down the replacement infusion any more. He doesn't have any cardiac or kidney history and isn't on a fluid restriction. Obtaining an order for the additional 50 mL per hour normal saline allowed me to get all three doses in on time."

Diuretics

Diuretics are a type of medication that decrease fluid volume. The mechanism of action differs for different categories of diuretics, as do the medications' effect on electrolytes. Loop diuretics inhibit NaCl reabsorption in the ascending loop of Henle of the kidney tubule. Common examples of loop diuretics include furosemide (Lasix),

bumetanide (Bumex), and torsemide. The nurse must monitor serum Na^+ and Cl^- levels, and also serum K^+ levels, because potassium is lost in the loop of Henle, as well.

Potassium-sparing diuretics are weak diuretics for managing FVE. They prevent sodium reabsorption in the collecting tubule, thereby increasing water elimination. However, potassium-sparing diuretics allow potassium reabsorption, thereby limiting potassium loss. Potassium-sparing diuretics are often used in combination with potassium-wasting diuretics for the purpose of maintaining serum potassium levels. Common potassium-sparing diuretics include spironolactone (e.g., Aldactone) and triamterene (Dyrenium).

Thiazide diuretics achieve fluid volume control by inhibiting NaCl reabsorption into the blood in the distal convoluted tubule. Thiazide diuretics are potassium-wasting diuretics; potassium is also lost in the distal part of the kidney tubule and the collecting ducts. Common thiazide diuretics include chlorothiazide (e.g., Diuril) and hydrochlorothiazide (e.g., Hydrodiuril). A common combination of a potassium-sparing and thiazide diuretic is triamterene/hydrochlorothiazide (e.g., Maxide).

Osmotic diuretics are made of solutes that are easily filtered through the glomeruli but are not reabsorbed from the tubules back into the blood. When administered, osmotic diuretics increase the blood osmolarity and draw fluid into the vascular space. The fluid is then filtered by the glomeruli and eliminated as urine, along with the solutes. Because of the increased water excretion with osmotic diuretics, all electrolytes plus bicarbonate are also lost at a higher rate. Mannitrol (e.g., Osmitrol) is an example of an osmotic diuretic. Isosorbide (Isordil) also works as an osmotic diuretic, although it is in a class of medications called nitrates.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety: Assessing the Appropriateness of Diuretic Administration

Disclaimer: Always follow the agency's policy for medication administration.

Definition: Minimize risk of harm to patients and providers through both system effectiveness and individual performance.

Knowledge: Delineate general categories of errors and hazards in care.

Skill: Demonstrate effective use of technology and standardized practices that support safety and quality. The nurse will:

- Review laboratory data when determining the safety of administering diuretics, particularly serum creatinine, potassium, and sodium levels, and serum HCT.
- Review the patient's fluid volume status indicators when determining the safety of administering diuretics:
  - I & O
  - perfusion indicators
  - vital signs

Attitude: The nurse will respect their individual role in preventing errors by adhering to safe, evidenced-based practice standards.

Administering Intravenous Fluid

When patients experience deficient fluid volume, IVFs are often prescribed. Intravenous fluid restores fluid to the intravascular compartment, and some IVFs are also used to facilitate the movement of fluid between compartments due to osmosis. There are three types of IVFs: isotonic, hypotonic, and hypertonic.

The osmotic gradient between two solutions is referred to **tonicity**, which is the suffix of the descriptive words iso*tonic*, hypo*tonic*, and hyper*tonic*. In this case, the two solutions are the IVF and the patient's blood. What type of tonicity and how much of a gradient exists will determine what happens in the venous system once the IVF is administered.

IVFs that have a similar concentration of dissolved particles as blood are **isotonic solutions**. An example of an isotonic IV solution is 0.9 percent normal saline (0.9 percent NaCl). Because the concentration of the IVF is similar

to the blood, the fluid stays in the intravascular space and osmosis does not cause fluid movement between compartments. Isotonic solutions are used for patients with FVD to raise their blood pressure. However, infusion of too much isotonic fluid can cause FVE.

Solutions that have a lower concentration of dissolved solutes than blood are **hypotonic solutions**. An example of a hypotonic IV solution is 0.45 percent normal saline (0.45 percent NaCl). Infusion of a hypotonic IV solution results in a decreased concentration of dissolved solutes in the blood as compared with the intracellular space. This imbalance causes osmotic movement of water from the intravascular compartment into the intracellular space. For this reason, hypotonic fluids are used to treat cellular dehydration.

However, if too much fluid moves out of the intravascular compartment into cells, cerebral edema can occur. It is also possible to cause worsening hypovolemia and hypotension if too much fluid moves out of the intravascular space and into the cells. Therefore, patient status should be monitored carefully when hypotonic solutions are infused.

Solutions that have a higher concentration of dissolved particles than blood are **hypertonic solutions**. An example of hypertonic IV solution is 3 percent normal saline (3 percent NaCl). When infused, hypertonic fluids cause an increased concentration of dissolved solutes in the intravascular space compared with the cells. This causes the osmotic movement of water out of the cells and into the intravascular space to dilute the solutes in the blood.

When administering hypertonic fluids, it is essential to monitor the patient for signs of hypervolemia, such as breathing difficulties and elevated blood pressure. Additionally, if hypertonic solutions with sodium are given, the patient's serum sodium level should be closely monitored. See Table 19.7 for a comparison of types of IV solutions, their uses, and nursing considerations.

Type	IV Solution	Uses	Nursing Considerations
Isotonic	0.9% Normal saline (0.9% NaCl)	Fluid resuscitation for hemorrhaging, severe vomiting, diarrhea, GI suctioning losses, wound drainage, mild hyponatremia, or blood transfusions	Monitor closely for hypervolemia, especially with heart failure or kidney failure.
Isotonic	Lactated Ringer's (LR) solution	Fluid resuscitation, GI tract fluid losses, burns, traumas, or metabolic acidosis. Often used during surgery	Should not be used if serum pH >7.5, because it will worsen alkalosis. May elevate potassium levels if used with kidney failure
Isotonic (starts as isotonic and then changes to hypotonic when dextrose is metabolized)	5% Dextrose in Water (D_5W)	Provides free water to help kidney excretion of solutes, hypernatremia, and some dextrose supplementation	Should not be used for fluid resuscitation because, after dextrose is metabolized, it becomes hypotonic and leaves the intravascular space, causing brain swelling. Used to dilute plasma electrolyte concentrations

TABLE 19.7 Comparison of IV Solutions

Type	IV Solution	Uses	Nursing Considerations
Hypotonic	0.45% NaCl	Used to treat intracellular dehydration and hypernatremia and to provide fluid for kidney excretion of solutes	Monitor closely for hypovolemia, hypotension, or confusion due to fluid shifting into the intracellular space, which can be life-threatening. Avoid use in patients with liver disease, trauma, and burns to prevent hypovolemia from worsening. Monitor closely for cerebral edema.
Hypotonic	D_5W	Provides free water to promote kidney excretion of solutes and treat hypernatremia, as well as some dextrose supplementation	Monitor closely for hypovolemia, hypotension, or confusion due to fluid shifting out of the intravascular space, which can be life-threatening. Avoid use in patients with liver disease, trauma, and burns to prevent hypovolemia from worsening. Monitor closely for cerebral edema.
Hypertonic	3% NaCl	Used to treat severe hyponatremia and cerebral edema	Monitor closely for hypervolemia, hypernatremia, and associated respiratory distress. Do not use it with patients experiencing heart failure, kidney failure, or conditions caused by cellular dehydration; it will worsen these conditions.

TABLE 19.7 Comparison of IV Solutions

Type	IV Solution	Uses	Nursing Considerations
Hypertonic	5% Dextrose ($D_5$0) and 0.45% NaCl	Used to treat severe hyponatremia and cerebral edema	Monitor closely for hypervolemia, hypernatremia, and associated respiratory distress. Do not use it with patients experiencing heart failure, kidney failure, or conditions caused by cellular dehydration; it will worsen these conditions.
Hypertonic	5% Dextrose and LR solution (D_5LR), $D_1$0	Used to treat severe hyponatremia and cerebral edema	Monitor closely for hypervolemia, hypernatremia, and associated respiratory distress. Do not use it with patients experiencing heart failure, kidney failure, or conditions caused by cellular dehydration; it will worsen these conditions.

TABLE 19.7 Comparison of IV Solutions

Assessing Intravascular Access

To administer IVFs, the nurse must ensure the patient has a correctly placed and functioning intravascular catheter of the correct size. The nurse should assess for intravascular access patency by withdrawing blood from the intravascular catheter. Using a slow and gentle technique, the nurse pulls back on the syringe attached to the intravascular catheter.

Additionally, assessment includes observing the insertion site by comparing it with the same area on the opposite side of the body, looking for erythema and edema, and palpating for warmth. Inflammation of a vein that is visible on the surface of the skin is called phlebitis. Phlebitis may be a complication of IVFs and should be observed at least once per shift and any time the intravascular catheter is used. The intravascular catheter should be flushed prior to and in between uses, and the nurse assesses for any discomfort during flushing. In most cases, IVFs will be administered using an IV infusion pump to avoid infusion rates that are too fast or too slow. See Table 19.8 for potential local complications of peripheral intravascular therapy.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Evidenced-Based Practice: Changing Peripheral Intravascular Catheters

Definition: Integrate the best clinical evidence with clinical expertise and patient and family preferences and values for delivery of optimal health care.

Knowledge: Describe how the strength and relevance of available evidence influence the choice of interventions in provision of patient-centered care.

Skills: Consult with clinical experts before deciding to deviate from evidence-based protocols. The nurse will:

- Recognize the Centers for Disease Control and Prevention (CDC) recommendation to change peripheral intravascular catheters (PICs) after they have been in the patient 72–96 hours (Webster et al., 2019)
- Follow institutional protocols, but assess PICs frequently, including locked PICs—at least every 4 hours and

early in the shift to determine patency.
- Be aware of medications that are considered vesicants when administered through PICs.

Attitude: The nurse will acknowledge their limitations in knowledge and clinical expertise before determining when to deviate from evidence-based best practice.

Complication	Potential Causes and Prevention	Treatment
Phlebitis: The inflammation of the vein's inner lining, the tunica intima. Clinical indications are localized redness, pain, heat, purulent drainage, and swelling that can track up the vein, leading to a palpable venous cord.	**Mechanical causes:** Inflammation of the vein's inner lining can be caused by the cannula rubbing and irritating the vein. To prevent mechanical inflammation, use the smallest gauge possible to deliver the medication or required fluids. **Chemical causes:** Inflammation of the vein's inner lining can be caused by medications or fluids with high alkaline, acidic, or hypertonic qualities. To avoid chemical phlebitis, follow the parenteral drug therapy guidelines in a drug reference resource for administering IV medications, including the appropriate amount of solution and rate of infusion. **Infectious causes:** May be related to emergent vascular access device insertions, poor aseptic technique, or contaminated dressings	**Chemical phlebitis:** Evaluate infusion therapy and the need for different vascular access, different medication, slower rate of infusion, or more dilute solution. If indicated, remove the vascular access device. **Transient mechanical phlebitis:** May be treatable by stabilizing the catheter, applying heat, elevating the affected limb, and providing analgesics as needed. Consider requesting other pharmacologic interventions such as anti-inflammatory agents, if needed. Monitor site for 24 hours after insertion, and if signs and symptoms persist, remove the catheter. **Infectious phlebitis:** If purulent drainage is present or infection is suspected, remove the catheter and obtain a culture of the purulent drainage and catheter tip. Monitor for signs of systemic infection.
Infiltration: A condition that occurs when a nonvesicant solution is inadvertently administered into surrounding tissue. Signs and symptoms include pain, swelling, redness, the skin surrounding the insertion site is cool to touch, there is a change in the quality or flow of IVF, the skin is tight around the intravascular access site, IVF is leaking from intravascular access site, or there are frequent alarms on the IV pump.	Infiltration is one of the most common complications in infusion therapy involving an intravascular catheter. For this reason, the patency of an intravascular access site must always be checked before administering IV push medications. Infiltration can be caused by piercing the vein, excessive patient movement, a dislodged or incorrectly placed intravascular catheter, or too rapid infusion of fluids or medications into a fragile vein. Always secure a PIC with tape or a stabilization device to avoid accidental dislodgement. Avoid sites that are areas of flexion.	Stop the infusion and remove the cannula. Follow agency policy related to infiltration.

TABLE 19.8 Local Complications of Peripheral IV Therapy (Source: Gorski, 2024.)

Complication	Potential Causes and Prevention	Treatment
Extravasation: A condition that occurs when vesicant (an irritating solution or medication) is administered and inadvertently leaks into surrounding tissue and causes damage. It is characterized by the same signs and symptoms as infiltration but also includes burning, stinging, redness, blistering, or necrosis of the tissue.	Extravasation has the same potential causes of infiltration but with worse consequences because of the effects of vesicants. Extravasation can result in severe tissue injury and necrosis. For this reason, known vesicant medications should be administered via central lines.	Stop the infusion. Detach all administration sets and aspirate from the catheter hub before removing the catheter to remove vesicant medication from the catheter lumen and as much as possible from the subcutaneous tissue. Follow agency policy regarding extravasation of specific medications. For example, toxic medications have a specific treatment plan.
Hemorrhage: Bleeding from the intravascular access site	Bleeding occurs when the intravascular catheter becomes dislodged.	If dislodgement occurs, apply pressure with gauze to the site until the bleeding stops, and then apply a sterile transparent dressing.
Local infection: Infection at the site is indicated by purulent drainage, typically 2–3 days after an intravascular access site is started.	Local infection is often caused by nonadherence to aseptic technique during intravascular access initiation or intravascular catheter maintenance, or the dressing becomes contaminated or nonintact over the access site.	Remove the cannula and clean the site using sterile technique. If infection is suspected, remove the catheter and obtain a culture of the purulent drainage and catheter tip. Monitor for signs of systemic infection.
Nerve injury	Paresthesia-type pain occurring during venipuncture or during an indwelling intravascular catheter can indicate nerve injury.	Immediately remove the cannula, notify the provider, and document findings in the chart.

TABLE 19.8 Local Complications of Peripheral IV Therapy (Source: Gorski, 2024.)

PATIENT CONVERSATIONS

What If Your Patient Doesn't Want a New Intravascular Access Site?

Scenario: Mrs. Arlene Schreiber was admitted for urosepsis and has been in the hospital for 8 days. She has a peripheral intravascular catheter that is 4 days old, and hospital policy indicates PICs can only be left in for 96 hours.

Nurse: Hi, Mrs. Schreiber, it is time to change your intravascular catheter site.

Patient: My intravascular catheter is fine; I don't want to change it. It doesn't hurt and it works fine.

Nurse: I understand you don't want to change it, but let me explain why it is important. Our hospital policy states we need to change peripheral intravascular catheters after 96 hours. That is the best recommendation from the Centers for Disease Control and Prevention. Research by their researchers found that intravascular catheters left longer can lead to blood infections and are more likely to cause fluids or medication to leak out of your veins.

Patient: But why fix something that isn't broken?

Nurse: Your doctors are indicating you are going to need at least 2 more days of antibiotics. You are going to need an intravascular catheter at least that long. Changing it now will save us from having to change it later when it might cause a problem or delay an antibiotic dose. There are a lot of good reasons to let us change your intravascular catheter today, but I can't force you to.

Patient: I just hate it so much. Can you promise me this is the last one I'm going to have to get?

Nurse: I wish I could, but no I can't make that promise. We can work together to find the best spot for the intravascular catheter, and I will do my best to find a good vein.

Age-Related Changes

There are several lifespan considerations when assessing for fluid and electrolyte balance. Newborns and infants have a large proportion of water weight compared with adults, with approximately 75 percent of weight being water. During the first week after birth, ECF is lost in urine, along with sodium. Additionally, compensatory mechanisms such as the RAAS are less developed, and newborn kidneys are less able to concentrate urine, resulting in a decreased ability to retain sodium. Newborns and infants also have a greater body surface area, making them more susceptible to insensible fluid losses through the skin and lungs via evaporation. This causes increased risk of developing hyponatremia and FVD. In contrast, newborns are less able to excrete potassium, placing them at risk for hyperkalemia. Episodes of vomiting and diarrhea also place infants at an increased risk of quickly developing fluid and electrolyte disturbances. When monitoring urine output in infants, parents are often asked about the number of wet diapers their infant has in a day. Nurses may also weigh diapers for hospitalized infants for more accurate measurement of urine output.

Children and adolescents are at risk for dehydration when physically active in hot environments that can cause excessive sweating. Illnesses causing diarrhea, vomiting, or fever can also quickly cause fluid deficit if there is little fluid intake to replace the water and sodium lost. For this reason, it is important to educate parents regarding the importance of fluid intake when their child is sweating or ill.

Older adults are at risk for fluid and electrolyte imbalances for a variety of reasons, including surgery, chronic diseases such as heart disease and kidney disease, diuretic use, and decreased mobility that limits the ability to obtain hydration. Older adults also have a decreased thirst reflex, which contributes to decreased fluid consumption. Kidney function naturally decreases with age, resulting in decreased sodium and water retention, as well as decreased potassium excretion. These factors place older patients at risk for FVD and electrolyte abnormalities.

PATIENT CONVERSATIONS

Encouraging Adequate Hydration

Scenario: A patient is discussing a concern with the nurse when the nurse hears something that requires further conversation and patient teaching.

Patient: It seems like the older I get, the less interested I am in food. I spent so many years trying to lose a few pounds, now I almost have to force myself to eat enough.

Nurse: What are the kinds of foods you usually eat?

Patient: Toast or cereal in the morning usually. I eat a lot of soup and crackers, maybe with cheese during the day. I just don't have an appetite for big meals anymore.

Nurse: What about beverages? Do you drink something throughout the day?

Patient: I drink coffee in the morning, just 1 cup of regular then I switch to decaf. If I feel thirsty, I make myself some tea.

Nurse: Feeling thirsty isn't a great way to judge if your body needs more fluid. The National Council on Aging recommends people your age drink one-third of their body weight in ounces. How much do you weigh?

Patient: These days probably only 110 pounds or so. I used to weigh so much more.

Nurse: At 110 pounds, you should drink around 35–40 ounces every day. That's 4–5 cups. Decaffeinated coffee can help to keep you hydrated and so can tea if it doesn't have a lot of sugar. Soup counts, too, but if you use canned soup, look at the nutrition label, because soup can contain a lot of sodium. Would you like me to help you look at some of your soup's nutrition labels?

Patient Education for Self-Management of Fluid and Electrolyte Balance

It is the nurse's responsibility to assess a patient's understanding of how to monitor and manage their fluid and electrolyte status, and to provide education at a level that corresponds with their learning needs and abilities. For patients at risk for a fluid volume alteration, the nurse can suggest the patient weigh themselves daily at home. Remind the patient to weigh themselves at a consistent time of day, ideally first thing in the morning, and to use the same scale and to wear the same amount of clothing to get an accurate weight. The nurse can also encourage the patient to specifically note if their rings or shoes become tight or socks leave an indentation on their skin when removed; these can also indicate an increasing fluid volume.

Helpful suggestions for the nurse to educate the patient on the best choices for food and beverage options depending on the patient's needs and goals were discussed earlier in this section. However, a general understanding of nutritional sources of electrolytes is necessary for the nurse to educate the patient about foods that deliver certain electrolytes, whether the goal is to encourage those foods in cases of deficiencies or to avoid those foods when patient levels are already elevated.

Calcium

Most people think of dairy foods when they think of calcium. Dairy foods are good sources of calcium, but they are also often high in sodium and saturated fat. Additionally, many people do not digest the lactose in dairy and, therefore, need to avoid foods that contain dairy. The nurse can recommend nondairy sources of calcium, including green leafy vegetables, as well as broccoli and edamame. Most beans and lentils are good sources of calcium, as are almonds and seeds like pumpkin, sesame, and chia seeds.

Chloride

Because of the added salt (sodium chloride) in many foods, dietary chloride deficiency, like dietary sodium deficiency, is rare. Because most dietary chloride is in the form of salt, sodium restrictions should be implemented for the patient trying to decrease chloride levels.

Magnesium

Unfortunately, dietary magnesium deficits are common in the United States, with up to 50 percent of Americans consuming less than the daily recommended dose, and some age groups, including children, consuming substantially less (Felton, 2024). Good sources of magnesium include green leafy vegetables, nuts, seeds, and most whole grains, such as whole wheat and oats.

Phosphorous

Because phosphorous levels have a negative relationship with calcium levels, the patient experiencing kidney disease often must avoid excess phosphorous. For healthy individuals, adequate dietary phosphorous is easily consumed through a diet containing a variety of lean animal meat, dairy, and seeds. Patients who are trying to decrease phosphorous intake should be made aware that most soda, especially colas, can be high in phosphorous.

Potassium

To modify the amount of dietary potassium a patient consumes, the nurse should educate the patient that potassium is found in green leafy vegetables like spinach, kale, and dark green lettuce. Other vegetables include root vegetables like potatoes, sweet potatoes, and carrots. Many fruits are high in potassium, including bananas, oranges, avocados, apples, and apricots, as well as fruits that grow on vines, such as tomatoes and pumpkin. Also educate patients that most salt substitutes are high in potassium.

Sodium

It is extremely rare for persons living in the United States to have a dietary deficiency of sodium (Felton, 2024). More often, the nurse will be educating the patient about foods that are high in sodium so they can avoid

unnecessary salt in the diet. Most people are not surprised to learn that a variety of savory snacks are high in sodium. Chips and crackers, pizza, and most fast foods are notoriously high in sodium. However, other foods have high sodium and are lesser known. Breads and rolls can contain high amounts of sodium, as can cheeses and cold-cut meats. Many soups have added sodium. Prepackaged or frozen foods often contain sodium for added flavor but also as a preservative. Any food not prepared at home can have added sodium. As mentioned previously, it is best for the patient to read nutrition labels and, when eating in restaurants, specifically ask about added salt.

It is important for the nurse to understand and clearly communicate if certain foods are to be encouraged or avoided. Patient preferences need to be included when assisting patients to choose foods. Sadly, fresh foods like fresh green leafy vegetables and raw nuts and seeds often are more expensive than less healthy, often processed foods (Lewis et al., 2023), and the nurse needs to be sensitive to individual's budgetary limitations and access to fresh healthy food. The nurse can also consult a dietitian to assist the patient with nutritional education and meal planning.

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 11

Refer back to Unfolding Case Study #3: Part 10 to review the patient data.

Nursing Notes	**2300:** Furosemide administered as ordered. Patient immediately urinated 500 mL of clear urine. Crackles in lungs improving and patient reports improvement in dyspnea.
Provider's Orders	**2340:** Morning laboratory tests: CBC, complete metabolic panel Daily weights Initiate 1,500 mL fluid restriction

5. Take action: What laboratory values should the nurse monitor closely after administering furosemide?
6. Evaluate outcomes: What assessment findings would the nurse anticipate if the interventions were successful?

19.4 Nursing Management of Elimination

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe nursing considerations for functional elimination
- Explain nursing management of peritoneal dialysis
- Identify nursing management of hemodialysis

This chapter looks at many diseases that can affect fluid and electrolyte balance. It is important for the nurse to remember that the elimination of excess fluids and electrolytes includes both the body's ability to filter and collect excess fluid and electrolytes, and the to remove the collection from the body. This section discusses bladder assessment, functional elimination, and peritoneal dialysis and hemodialysis.

Nursing Considerations for Alterations in Functional Fluid and Electrolyte Elimination

When a person thinks about urinary elimination, often what comes to mind is the need to urinate, badly and at the most inconvenient times. However, urinary elimination is actually a complex and multisystem process. The structures of the kidneys must remain healthy for blood to be filtered and urine created. The ureters must be patent and able to assist urine to get to the bladder. The bladder must have a healthy connection to the spinal cord and brain to sense the presence of urine and be able to contract forcefully enough to get urine out. Unfortunately, difficulties can arise from any of these parts that contribute to urinary elimination.

Assessing Bladder Function

The creation and elimination of urine alone do not guarantee normal or adequate fluid and electrolyte balance. The patient may be able to void light-yellow urine but still have a FVE or deficit and an electrolyte imbalance. The nurse must consider a full fluid and electrolyte assessment to determine if the patient is meeting the demands for homeostasis. However, one aspect of fluid and solute waste elimination is bladder function.

If the patient's fluid and regulatory systems, discussed throughout this section, result in the formation of urine, then adequate bladder function is necessary to eliminate urine. If a patient is consuming or receiving adequate intake but is not eliminating urine, the nurse should perform a bladder assessment to determine if urine is present in the bladder.

The patient should be comfortably lying supine, and privacy ensured. Beginning with light palpation, the nurse will assess the lower abdomen. The bladder is below the umbilicus in the lower abdomen and is not palpable when empty. Using deeper palpation, the nurse should attempt to feel the base of the bladder. If the bladder is palpable, the nurse should continue to palpate, outlining the bladder. A bladder that is mildly full will be slightly firm and nontender, below the umbilicus. A bladder that is full may be firm and may extend above the umbilicus.

A more objective method to assess for the presence of urine in the bladder is to use a bladder scanner. To perform a bladder scan, place the scanner head about 1 inch above the symphysis pubis, pointing slightly down toward the expected bladder location. The screen will display an ultrasound image of the bladder. The bladder should be centered on the screen—often within a crosshair image. Once the nurse has the correct position, the scanner will scan the bladder and indicate a volume of urine within the bladder. Often, nurses will perform multiple scans to guarantee an accurate reading.

A straight catheter is used for **intermittent catheterization** of urine. The catheter is inserted to allow for the flow of urine and then is immediately removed, so a balloon is not required at the insertion tip. Intermittent catheterization is used for the temporary relief of urinary retention. It may be performed once, such as after surgery when a patient is experiencing urinary retention due to the effects of anesthesia, or several times a day to manage chronic urinary retention. Some patients may also independently perform self-catheterization at home to manage chronic urinary retention caused by various medical conditions. In some situations, a straight catheter is also used to obtain a sterile urine specimen for culture when a patient is unable to void into a sterile specimen cup. According to the CDC, intermittent catheterization is preferred to indwelling urethral catheters whenever feasible because of decreased risk of developing a urinary tract infection (UTI).

At times, the patient may be making urine and able to eliminate some urine, but not fully empty their bladder. If this is suspected, the provider may request a **post-void residual (PVR)** assessment. The nurse should ask the patient to fully empty their bladder, and then, using either a bladder scanner or straight catheterization, assess how much urine is left in the bladder. This amount is reported to the provider and/or documented. A PVR of less than 50 mL is expected if the bladder is adequately emptying. In older adult patients, that volume may increase to 100 mL and still be considered adequate emptying. A PVR of greater than 200 mL is considered abnormal, and a value of 400 mL or greater is considered a high amount of urinary retention (Ballstaedt & Woodbury, 2023). The provider should be notified of anything outside the normal range.

Incontinence

Urinary output can be difficult for the nurse to measure, and urinary elimination can be difficult for the patient to manage during **urinary incontinence (UI)**. Urinary incontinence is a loss of urine from the bladder that is unplanned or uncontrolled. Urinary incontinence can range from an occasional small leak of urine to full bladder emptying.

There are several types of UI. To assist in determining what type the patient experiences, the nurse should ask the patient about urinary frequency, urinary urgency, and urinary leaking. Urinary frequency can indicate a type of UI called **overflow incontinence**. In overflow incontinence, the bladder does not fully empty during trips to the toilet, and incontinence occurs because the bladder is too full or overflowing. In this case, pharmacological treatment is directed toward medications that increase bladder contraction, which are cholinergic drugs, such as bethanechol (e.g., Urecholine). Urinary urgency may result in **urge incontinence**. Urge incontinence, often termed overactive bladder, results in the feeling of the need to urinate and urine leaking even when the bladder is not full. Typically, drugs that are anticholinergic, such as oxybutynin (Ditropan) are used to treat urge incontinence. Another type of urinary incontinence, **stress incontinence**, is the result of a weak urethral sphincter, weak pelvic floor muscles, or

both, that allow urine to escape during times of increased intra-abdominal pressure, such as may occur with laughing, coughing, jumping, and so forth. Stress incontinence treatments often focus on increasing pelvic floor muscle strength. Kegel exercises are one example. Often, UI is a combination of two or more types and is called **mixed incontinence**.

Lastly, **functional urinary incontinence** may be the most difficult type of UI to manage. In functional UI, the bladder and support structures are functioning properly but other illness or disability prevents the patient from being able to access the toilet. Examples include patients experiencing dementia for whom acknowledging and communicating the need to urinate are challenging, or patients who require assistance to the toilet as a result of residual physical deficits from a cerebral vascular accident, falls, or other debilitations.

Most UI is treatable. Unfortunately, there is a misconception that UI is a normal part of aging and often is not addressed. Fifty percent of residents in long-term care facilities experience UI (McDaniel et al., 2020). Urinary incontinence is associated with a decreased quality of life and decreased interpersonal interaction due to embarrassment, frustration, depression, and loss of self-esteem. Additionally, UI is associated with a higher risk for skin integrity alterations, falls, and UTIs. It is estimated that medical cost associated with UI exceeds $5 billion (McDaniel et al., 2020).

Indwelling Urinary Catheter Management

An **indwelling urinary catheter (IUC)** is a urinary catheter that stays in the bladder for a time. The term "Foley catheter" is used interchangeably, although "Foley" is the brand name of a type of IUC invented by a man named Frederic Foley in 1929 (UroToday, n.d.). An IUC has two proximal lumens and an inflatable balloon on the distal end. The balloon volume can vary, but is generally 10 mL to 30 mL. The IUC is inserted through the urethra into the bladder. The balloon is inflated inside the bladder by injecting sterile water into one of the proximal lumens. The other proximal lumen terminates with a hole on the end of the catheter and drains urine into a collecting bag (Figure 19.13). In IUCs that have three proximal lumens, the third is for bladder irrigation. These are called "three-way IUCs."

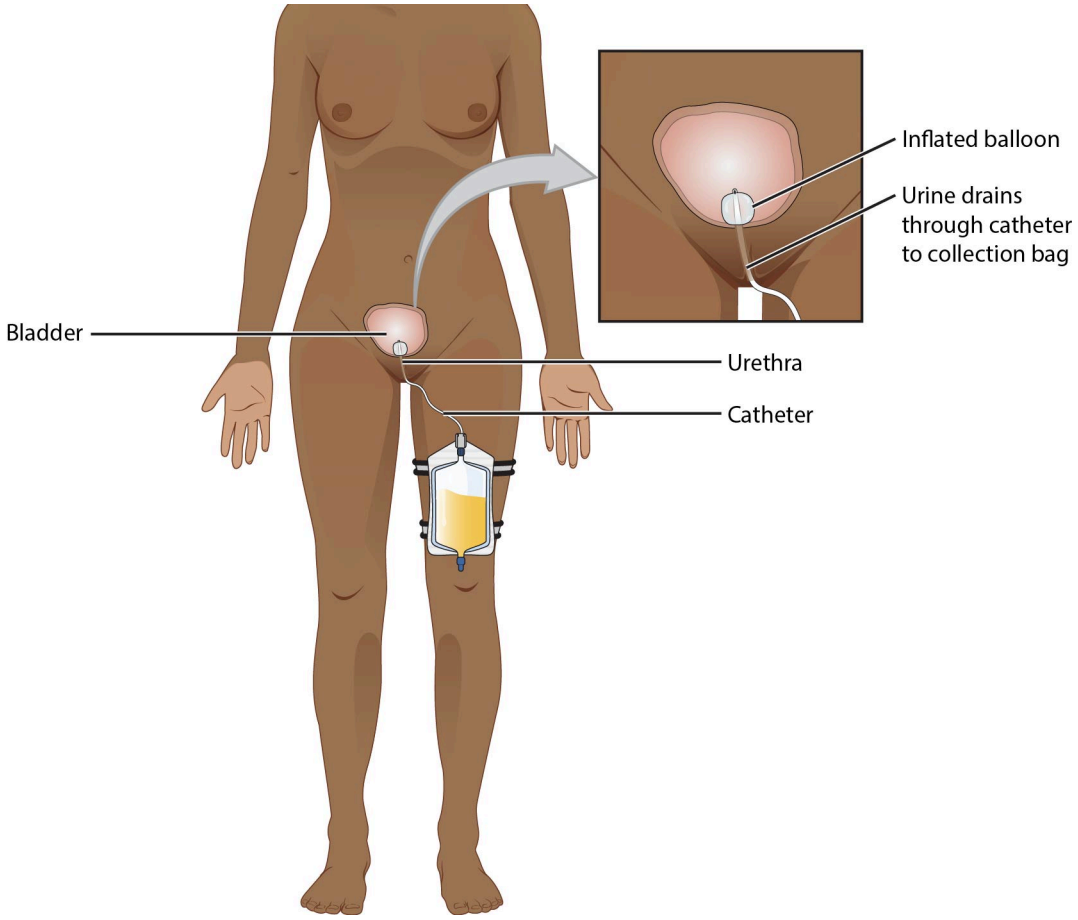

FIGURE 19.13 An IUC drains urine from the bladder into a collection bag. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Applying an External Urinary Sheath (Condom Catheter), Catheterizing the Female Urinary Bladder, and Catheterizing the Male Urinary Bladder

See the competency checklists for Applying an External Urinary Sheath (Condom Catheter), Catheterizing the Female Urinary Bladder, and Catheterizing the Male Urinary Bladder. You can find the checklists on the Student resources tab of your book page on openstax.org.

A **catheter-associated urinary tract infection (CAUTI)** is a common, life-threatening complication caused by IUCs. The development of a CAUTI is associated with patients' increased length of stay in the hospital, resulting in additional hospital costs and a higher risk of death. It is estimated that up to 69 percent of CAUTI cases are preventable, meaning that up to 380,000 infections and 9,000 patient deaths per year related to CAUTI can be prevented with appropriate nursing measures (CDC, 2015).

Nurses can save lives, prevent harm, and lower healthcare costs by following key interventions (American Nurse's Association, n.d.):

- Ensure the patient meets CDC-approved indications before inserting an IUC. If the patient does not meet the approved indications, contact the provider and advocate for an alternative method to facilitate elimination.
- According to the CDC, appropriate indications for inserting an IUC include the following:
  - end-of-life care
  - healing of open sacral and perineal wounds in patients with UI
  - hourly monitoring of urinary output in critically ill patients
  - perioperative use for selected surgeries

    - prolonged immobilization
    - urinary retention or bladder outlet obstruction
- Inappropriate reasons for inserting an IUC include the following:
    - prolonged postoperative care without appropriate indications
    - substitution of nursing care for a patient or resident with incontinence
    - to obtaining a urine culture when a patient can voluntarily void
- After an IUC is inserted, assess the patient daily to determine if the patient still meets the CDC criteria for an indwelling catheter and document the findings. If the patient no longer meets the approved criteria, follow agency policy for removal.
- When an IUC is in place, prevent CAUTI by following the maintenance steps outlined by the CDC.
- Continually monitor for signs of a CAUTI and report concerns to the healthcare provider.
- Signs and symptoms of a CAUTI to urgently report to the healthcare provider include fever greater than 100.4°F (38°C); change in mental status, such as confusion or lethargy; chills; malodorous urine; and suprapubic or flank pain. Flank pain can be assessed by assisting the patient to a sitting or side-lying position and percussing the costovertebral areas.

LIFE-STAGE CONTEXT

UTI in Older Adults

Urinary tract infections have a typical presentation in adolescents and adults. Urinary frequency, urgency, and burning are all common manifestations of UTIs. However, in older-adult populations, UTIs often present atypically with a change in personality or level of interaction, confusion or delirium, new incontinence, sleepiness, diminished appetite, and/or frequent falls (Dutta et al., 2022).

Providing Education

At times, a patient may need to be at home with an IUC. The nurse should provide education focused on preventing CAUTI and maximizing patient quality of life. The nurse will teach the patient how and when to clean the catheter. At least twice daily and after any bowel movement, using soap and water and a clean washcloth, the patient should gently wipe from the urinary meatus toward the collecting bag. The patient may shower and clean the catheter in the shower in the same manner. If the patient desires to be out in public, a leg bag can be used under the patient's clothing to conceal the urine-collecting bag (Figure 19.14). The patient should be taught to wash their hands before manipulating collecting bags. The patient should clean the bag connector with soap and water and allow it to dry whenever changing bags. When not in use, the bags should be washed in soap and water and allowed to dry thoroughly.

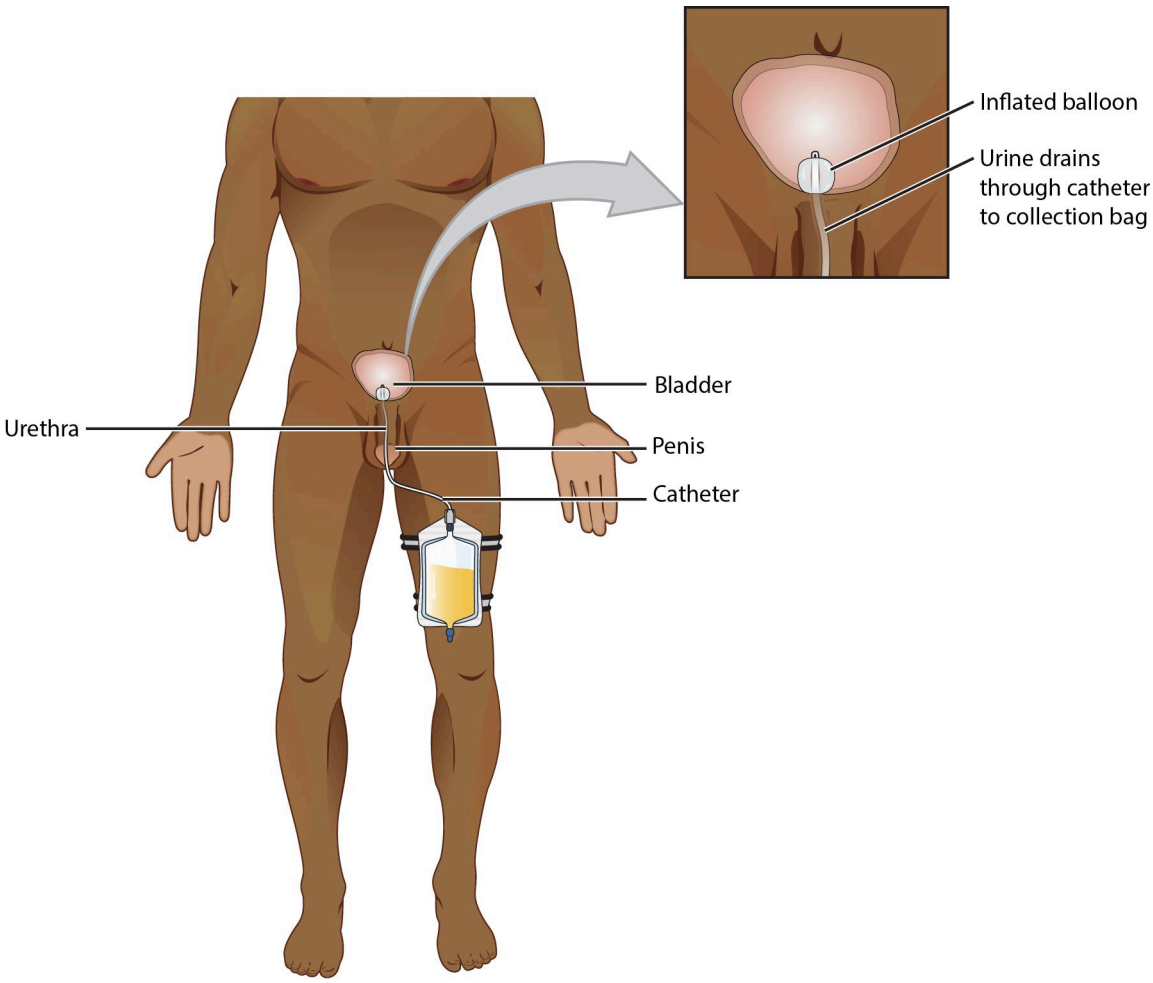

FIGURE 19.14 An indwelling catheter may be attached to a leg bag to disguise under clothing. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Dialysis

For some patients, the body is unable to adequately filter water, electrolytes, and waste products. In this case, the patient will require an external method to adequately clean the blood. These patients must undergo **dialysis**, a procedure to remove waste products and excess fluids from the blood when the kidneys are unable to do so. There are two types of dialysis: peritoneal dialysis (PD) and hemodialysis (HD). Both types of dialysis rely on water osmosis and solute diffusion between the blood and another compartment.

Nursing Management of Peritoneal Dialysis

In **peritoneal dialysis**, the peritoneal cavity is used as the other compartment. The peritoneal cavity is lined with tiny capillaries perfusing with blood. Dialysate, a fluid created in a pharmacy with a prescribed fluid, electrolyte, and other solute composition is instilled into the peritoneal cavity and dwells around the abdominal organs, exchanging fluids, electrolytes, and other solutes with the capillaries (Figure 19.15). When the exchange has had adequate time, the dialysate along with any additional fluid and solute is removed.

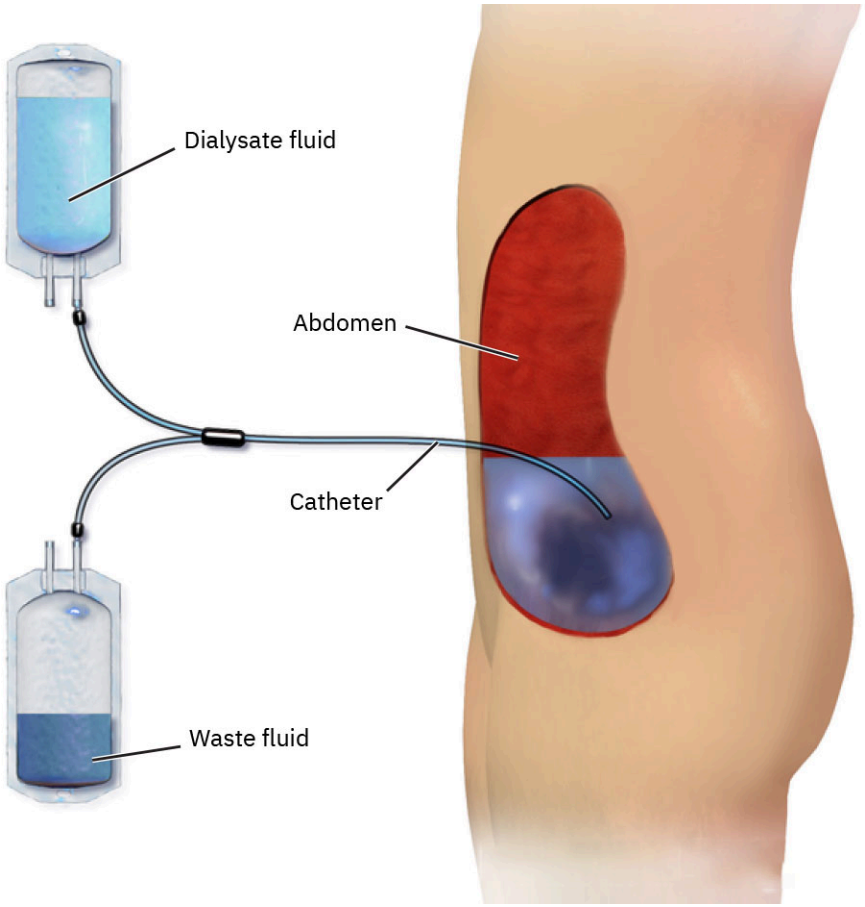

FIGURE 19.15 PD uses the capillaries in the peritoneal cavity to exchange waste products. (credit: modification of "Blausen 0160 CAPD" by "BruceBlaus"/Wikimedia Commons, CC BY 3.0)

For a patient to receive PD, a peritoneal cavity access site is established in the patient's abdomen. A nephrologist will determine the correct dialysate concentration based on the patient's kidney function and laboratory data and prescribe the frequency and length of time the dialysate should dwell inside the patient's abdomen. One significant advantage of PD is a patient's ability to perform it at home. The nurse is an important source of education and support.

Assessment of the Access Site

The peritoneal catheter is placed percutaneously by a surgeon using a laparoscopic technique. The catheter is a flexible silicone tube with several holes inside and a closable external port. A cuff is present on the outside of the patient's abdomen to prevent the catheter from migrating too far into the abdomen and to allow the catheter to be secured to the abdomen. In some cases, a cuff is also present under the skin surface. The nurse will assess and instruct the patient to monitor the insertion site for signs and symptoms of infection. Skin flora is the most likely cause of catheter insertion site infection, so the site should be cleansed with soap and water or another approved antiseptic and covered with a sterile dressing when not being used. Additionally, the site should be monitored for leakage around the catheter during use. Too much leakage can decrease the effectiveness of dialysis. The patient should report any concern to their nephrologist.

Monitoring for Complications

The nurse will instruct the patient to closely monitor how much dialysate is instilled and how much effluent (dialysate plus all waste) is returned. The patient's nephrologist will provide an acceptable quantity of effluent, but the amount of effluent is always greater than the amount of dialysate. If all dialysate is not returned, the patient may need to reposition. In some cases, the peritoneal catheter may be clogged or dislodged. In such situations, the patient should seek urgent medical care. In addition to the amount of effluent, the nurse will educate the patient to note the color and clarity of the effluent.

Nursing Management of Hemodialysis

The decision regarding the type of dialysis will be made by the patient in conjunction with the provider considering multiple factors, including the degree of kidney disease, the patient's lifestyle goals, and the patient's confidence in their ability and desire to perform PD. If HD is the best choice for a patient, the nurse's role is focused on educating the patient about how to care for their HD access and how best to maintain fluid and electrolyte levels in between HD visits. Unlike PD, HD uses an external filter as the second compartment and blood is filtered outside of the body. Hemodialysis is usually delivered in a hospital or outpatient HD clinic setting. The patient is a more passive recipient in HD.

PATIENT CONVERSATIONS

Offering Your Opinion When You Are Asked

Scenario: The nurse is caring for a patient recently diagnosed with chronic kidney disease and who is now requiring dialysis. The patient's adult son and documented representative asks the nurse if she thinks the patient would be better off having PD or HD. The nephrologist has provided education about both options and has asked the patient and family to make a decision.

Patient's son: You've been working with mom for several days now. What do you think? Should she try peritoneal dialysis or just go straight to hemodialysis?

Nurse: Well, do you think she will be able to manage peritoneal dialysis on her own or will she need one of her children to help her with it?

Patient's son: I think we'd need to be there. She was already having trouble remembering her medications before she came to the hospital.

Nurse: It is plausible for your or your brother to sister to be there several times a day or find someone who can be there?

Patient's son: It sound like too much. Mother's going to hate having people in and out of her house all the time and she hates depending on her "babies."

Nurse: That sounds like a good reason to go with hemodialysis. If she likes her independence, you can coordinate a ride to get her to the dialysis clinic, but she won't have to rely on her children as much. It sounds like a good option; however, your mom is the one who will ultimately make the decision.

Assessment of the Access Site

Hemodialysis access can take two different forms. A large-bore central venous catheter, often referred to as a Vascath, is a short-term HD access catheter. There is a significant risk of infection with Vascaths due to their size, location, and the frequency with which they are accessed. In most cases, nurses specially trained in HD care for HD catheters. However, the nurse caring for the patient will still assess the catheter insertion site for signs and symptoms of infection and monitor the patient for fever and/or white blood cell count elevation, Additionally, the nurse should assess the catheter dressing and ensure it is clean, dry, and intact. If there is drainage present or the dressing is not occlusive, the nurse should change the dressing using sterile procedure for central-line dressing changes.

A variation of the Vascath is the tunneled catheter. The tunneled catheter, commonly called a permacath, is also a large-bore central catheter, but the insertion site differs. The tunneled catheter is inserted several inches away from where it enters the vein. The catheter is inserted and then "tunneled" underneath the skin of the abdomen and/or chest wall before it enters the vein. In this way, skin flora and other organisms are not directly in line with the venous system and there is a lower risk of infection (Figure 19.16).

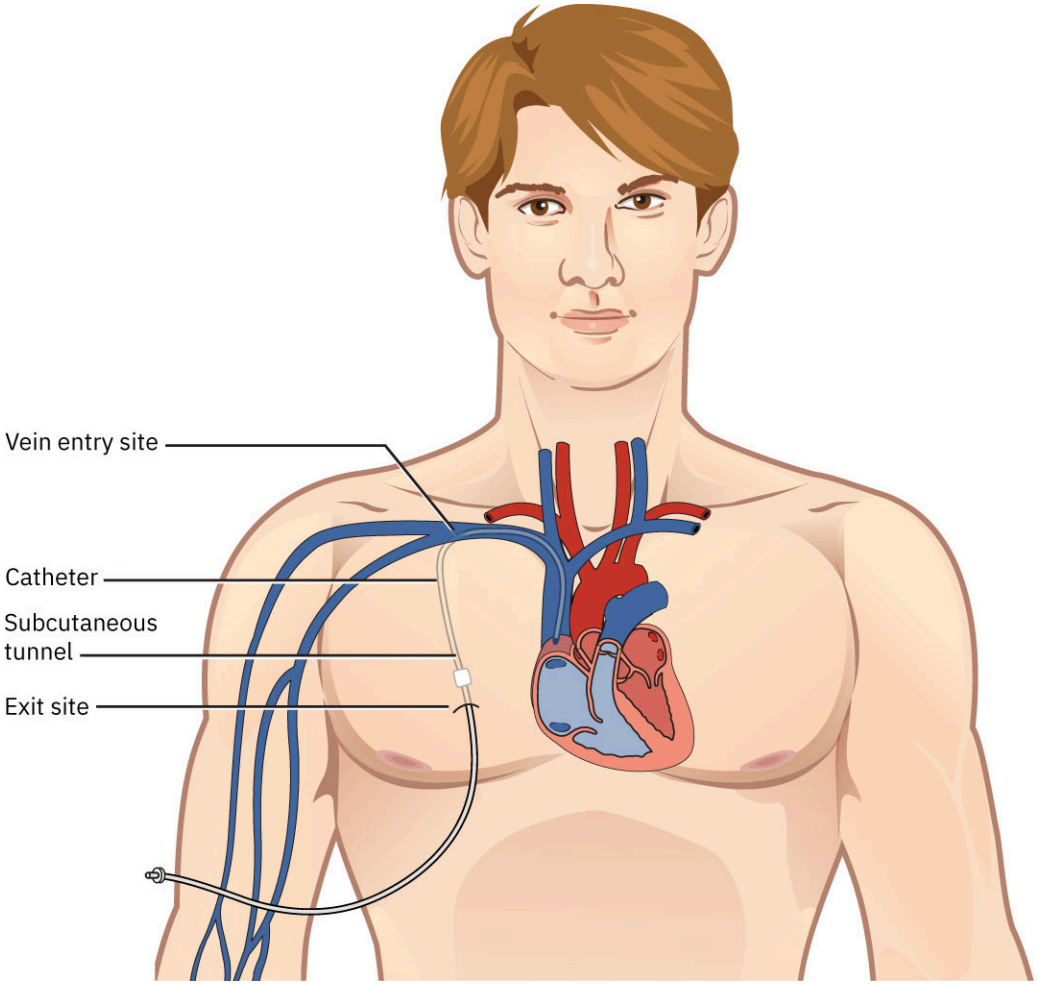

FIGURE 19.16 A tunneled HD catheter decreases the risk for infection. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Teamwork and Collaboration (T & C): Giving Report to the HD Nurse

Definition: Function effectively within nursing and interprofessional teams, fostering open communication, mutual respect, and shared decision-making to achieve quality patient care.

Knowledge: Recognize contributions of other individuals and groups in helping the patient and family achieve health goals.

Skill: Follow communication practices that minimize risks associated with handoffs among providers and across transitions in care. The nurse will:

- Provide a full report to the HD nurse who will be caring for the patient while the patient is in dialysis.
- Include any information about patient preferences, pain control, meals, and snacks that will allow for the best experience for the patient.

Attitude: Appreciate the risks associated with handoffs among providers and across transitions in care.

A more permanent HD access is a surgical procedure that connects an artery and a vein, usually in the patient's upper arm. If the connection is made by opening and sewing together an artery and a vein, the result is called an arteriovenous (AV) fistula. If the connection is made using a graft, either from a blood vessel from the patient or a synthetic graft, the result is called an AV graft. In either case, a surgical procedure is performed, and the nurse will assess the patient for postsurgical complications and for incision healing. Additionally, due to the high blood flow

through the fistula or graft, the nurse will assess for a thrill by gently palpating the fistula or graft site. A positive thrill feels like a vibration. The nurse will auscultate using a stethoscope and listen for a bruit over the fistula or graft site. A bruit sounds like a strong arterial whooshing. The patient should also be taught to also feel for a thrill. The presence of a thrill indicates blood is flowing through the fistula or graft. If the thrill and bruit are not present, the nurse and/or the patient should contact the nephrologist and the HD unit or clinic.

LINK TO LEARNING

This video (https://openstax.org/r/77avfistula) shows you how to conduct an AV fistula assessment.

The nurse should teach the patient to avoid wearing any tight clothing or shirt sleeves near the HD access site. Patients should avoid carrying purses or grocery bags hanging from the affected arm. Patients should also be aware that no blood pressure cuffs or tourniquets should be used on that arm. In the hospital setting, the nurse should follow hospital protocol to notify other staff and ensure no blood pressure, IVFs, or blood draws occur on the affected side.

Monitoring for Complications

Several HD complications are related to the access site. Infection, sepsis, and air embolism are possible with HD catheters. Fistulas and grafts can occlude and leave the patient without HD access. Other complications are related to the rapid change in a patient's fluid volume status and electrolyte levels. Hemodialysis is usually performed about three times each week. Prior to HD, patients may experience FVE, hypervolemia, hypertension, and altered electrolyte and acid-base balances. Immediately after HD, patients can experience hypovolemia and hypotension, and although electrolyte and acid-base balance is restored, the rapid change can cause nausea, vomiting, headache, and muscle cramping. Most patients report feeling fatigued after dialysis. The nurse will assess for manifestations of these alterations and focus on providing the patient rest.

Summary

19.1 Fluid and Electrolytes

Homeostasis is necessary for proper body functioning. An adequate fluid balance gives shape and size to cells and tissues, allows blood to perfuse to cells and tissues, and is a catalyst for hundreds of biochemical processes that keep our bodies alive. Electrolyte levels are finely monitored by multiple mechanisms, including digestive absorption, in-body storage, and kidney and hormonal regulation. When the body systems function correctly and people consume adequate fluid and healthy foods, homeostasis in maintained. This section discussed why some systems fail to adequately regulate fluids and electrolytes and what manifestations will alert the nurse that a regulation system is not functioning correctly. The nurse's role is to understand what normal fluid and regulation assessment indicators are, and to monitor for deviations. The nurse understands and, along with other healthcare team members, implements interventions to prevent and correct alterations in fluid and electrolyte balances.

19.2 Nursing Assessment for Fluid and Electrolytes

There are many factors the nurse must consider when assessing a patient's fluid status. No lone indicator can determine a patient's fluid volume status. The nurse, in collaboration with the healthcare team must evaluate all data including a patient's history, physical assessment, I & O, weight changes, and laboratory values. The nurse contributes to the healthcare team with accurate and consistent assessment and documentation of skin, vital signs, I & O, weight and laboratory values and clearly communicates unexpected findings to the care team members.

19.3 Considerations for Fluid and Electrolyte Imbalances

The nurse plays a key role in modifying a patient's fluid and electrolyte status. Nurses educate and encourage patients on how to follow prescribed dietary and fluid restriction limits. The knowledge and experience of the nurse can help the patient make the best choices for their health and for their enjoyment of eating. Nurses understand the implications of supplements and stress to patients that any vitamins and electrolytes supplements should be included on the patients list of current medications.

Intravenous fluids are fast way to influence fluid and electrolyte levels. The nurse must understand the rationale for an IVF infusion just as the nurse understands the rationale for any medication, and must monitor for unexpected side effects as with any medication.

19.4 Nursing Management of Elimination

Patients who experience special needs regarding urine creation and/or elimination require special attention from the nurse. Urine that is not able to be expelled from the bladder can back up and cause discomfort, and lead to kidney injury. Incontinence can lead to isolation and decreased quality of life, and is expensive. Both PD and HD are associated with a high risk for infection yet are lifesaving treatments that take the place of fully functioning kidneys. The nurse can provide intervention to prevent kidney, skin, and systemic complications for patients who experience these alterations in elimination.

Key Terms

active transport involves moving solutes and ions across a cell membrane from an area of lower concentration to an area of higher concentration

anasarca severe and generalized edema throughout the body

BUN to creatinine ratio a comparison of BUN to creatinine to determine if alterations in BUN and creatinine are related to changes in fluid volume or kidney filtration

Catheter-associated urinary tract infection (CAUTI) a urinary tract infection that develops directly related to the presence of an IUC

dialysis procedure to remove waste products and excess fluids from the blood when the kidneys cannot

diffusion the movement of molecules from an area of higher concentration to an area of lower concentration to equalize the concentration of solutes throughout an area

edema swelling caused by excessive buildup of fluid in tissue spaces or a body cavity

enophthalmos sunken eyes

extracellular fluid (ECF) fluid located outside of cells

filtration occurs when hydrostatic pressure pushes fluids and solutes through a permeable membrane so they can be excreted
fluid balance the difference between intake and output
fluid volume deficit (FVD) results from a loss of body fluids or fluid that becomes unavailable in the body for use
fluid volume excess (FVE) increased fluid retained in the intravascular compartment
functional urinary incontinence the inability to access a toilet due to physical or cognitive challenges
homeostasis the maintenance of equilibrium of two or more interdependent elements
hypercalcemia serum calcium level >10.5 mg/dL
hyperchloremia serum chloride level >105 mEq/L
hyperkalemia serum potassium level > 5.1 mEq/L
hypermagnesemia magnesium level >2.2 mg/dL
hyperphosphatemia phosphate level >4.8 mg/dL
hypertonic solution has a higher concentration of dissolved particles than does blood
hypervolemia excessive fluid volume
hypocalcemia total serum calcium level <8.5 mg/dL or an ionized calcium level <4.6 mg/dL
hypochloremia serum chloride level <97 mEq/L
hypokalemia serum potassium level <3.7 mEq/L
hypomagnesemia serum magnesium level <1.7 mg/dL
hyponatremia serum sodium level of <136 mEq/L
hypophosphatemia serum phosphate level <2.5 mg/dL.
hypotonic hyponatremia serum sodium level is decreased due to dilution
hypotonic solution has a lower concentration of dissolved solutes than does blood
hypovolemia deficient fluid volume
indwelling urinary catheter (IUC) a urinary catheter that stays in the bladder for a time
intermittent catheterization used for the temporary relief of urinary retention
interstitial fluid fluid outside of blood vessels and between the cells
intracellular fluid (ICF) found inside cells; comprise protein, water, electrolytes, and solutes
intravascular fluid fluid in the vascular system
isotonic solution has a similar concentration of dissolved particles as blood
mixed urinary incontinence two or more types of urinary incontinence that occur in the same individual
oncotic pressure pressure inside the vascular compartment created by protein content of the blood (in the form of albumin) that holds water inside the blood vessels
orthostatic vital signs (also known as postural vital signs) assessing a patient's blood pressure when the patient is lying supine and comparing it to the patient's blood pressure when either sitting upright or standing upright
osmolality a measure of the concentration of dissolved solutes in the blood
osmosis water movement through a semipermeable membrane, from an area of lesser solute concentration to an area of greater solute concentration, in an attempt to equalize the solute concentrations on either side of the membrane
overflow incontinence when bladder contraction fails to fully empty the bladder and urine leaks due to the high pressure from urine retention
peritoneal dialysis uses the capillaries in the peritoneal cavity to exchange waste products
post-void residual (PVD) determined by assessing the amount of urine that remains in the bladder immediately after the patient attempts to empty their bladder
skin turgor the elasticity of the skin assessed by pinching the skin into a tent shape and assessing how quickly the skin returns to its normal position
solute soluble particle
stress incontinence urine leakage during times of increased intrabdominal pressure
third spacing type of hypovolemia in which total body fluid may be adequate or even excessive, but fluid has moved out of the intravascular space and into the interstitial space
tonicity the osmotic gradient between two solutions
transcellular fluid fluid in cerebrospinal, synovial, and intrapleural areas, for example, and the gastrointestinal system
urge incontinence an overactive bladder that contracts and causes urine leakage when the bladder is not full

urinary incontinence (UI) unintentional and uncontrollable urine leakage
urine specific gravity a urine test that commonly measures hydration status by measuring the concentration of particles in urine

Assessments

Review Questions

1. The nurse is caring for a patient experiencing nephrotic syndrome, which allows large amounts of plasma proteins to filter through the glomeruli of the kidneys and be eliminated in urine. What manifestation does the nurse anticipate this patient will exhibit?
    a. hypervolemia
    b. third spacing
    c. hypochloremia
    d. bounding pulses

2. An 82-year-old patient asks the nurse how much water she should drink every day. What additional information does the nurse prioritize obtaining to answer this question?
    a. "What is your favorite beverage?"
    b. "Do you have a bathroom scale you can use to weigh yourself?"
    c. "Do you think you are not drinking enough water?"
    d. "Have you experienced any cardiac or kidney problems?"

3. What would a patient with a serum calcium level of 14.3 mg/dL most likely be experiencing?
    a. hyperparathyroidism
    b. adrenal insufficiency
    c. diabetes insipidus
    d. SIADH

4. A nurse determines a patient's skin feels dry and there are small bumps present on the skin surface of the arms and legs. What question is best for the nurse to ask to gather more data?
    a. "Are you drinking an adequate amount of water every day?"
    b. "Have you always had dry skin?"
    c. "Tell me about your skin care routine"
    d. "Do you have a dermatologist?"

5. A nurse is reviewing morning laboratory results on a series of patients. What patient should the nurse see first?
    a. a patient with a BUN level of 16.4 mg/dL and creatinine level of 0.8 mg/dL
    b. a patient with a blood pressure of 130/82 mm Hg with a history of hypertension
    c. a patient with a HCT of 27 percent who had surgery yesterday
    d. a patient complaining of being thirsty after being NPO for several hours awaiting a scheduled procedure

6. The nurse is reviewing the charting of an unlicensed assistant (UA) and notices the UA documented 1 cup of ice chips as 120 mL of oral intake. What response by the nurse is appropriate?
    a. Explain to the UA that a cup of ice is equal to 240 mL.
    b. Change the intake amount to 480 mL.
    c. Educate the UA that ice is not considered oral intake, because it is a solid.
    d. Take no action because the UA documented correctly.

7. The nurse empties the urinary catheter of a patient and notes the urine is a dark tea color. What should the nurse do first?
    a. Encourage the patient to drink more fluids.
    b. Send a urine sample to the laboratory for a specific gravity analysis.

c. Contact the provider for an order to start an IV
d. Review the patient I & O balance for the past several days.

8. The nurse is caring for a patient who is experiencing third spacing due to hyponatremia. What IVF, if requested, will address third spacing?
a. 0.45% NaCl
b. D_5W
c. Lactated Ringer's solution
d. D_50 and 45% NaCl

9. The nurse is assisting a patient who is on a fluid restriction to choose the best beverage option. The patient's goal is to limit sodium and sugar and to increase protein. What should the nurse encourage the patient to choose?
a. vegetable juice
b. milk
c. apple juice
d. cola

10. The nurse is prescribed to administer 50 mg of spironolactone (e.g., Aldactone). For which serum laboratory value might spironolactone be contraindicated?
a. $K^+ = 4.7$ mEq/L
b. $K^+ = 3.7$ mEq/L
c. $K^+ = 2.9$ mEq/L
d. $K^+ = 2.1$ mEq/L

11. A runner is brought to the rescue tent at a local marathon. The woman states she is feeling extremely thirsty and having some leg cramps. Her blood pressure is 106/76 mm Hg and her resting heart rate is 82 bpm. What type of IVF would be best to administer to this patient?
a. hypertonic
b. hypotonic
c. isotonic
d. tonicity

12. A nurse is planning the care for a patient with functional incontinence. What intervention is included in the plan of care?
a. Encourage adequate oral intake.
b. Assess for bladder distention every shift.
c. Assist the patient onto the bedpan every 2 to 3 hours.
d. Place an adult diaper on the patient.

13. The nurse is providing education to a patient planning to do self-care with PD at home. What statement by the patient indicates the patient requires additional information?
a. "I will wash my hands before connecting the dialysate bag to my PD catheter."
b. "The effluent volume should be one-half the dialysate volume."
c. "The effluent should be clear and look like urine."
d. "I will cover my PD catheter and insertion site when I'm not using the catheter."

14. The provider orders morning laboratory tests for a patient with an AV fistula, but the phlebotomist is unable to get any blood from the patient's nonaffected arm. What should happen next?
a. The nurse should obtain the specimen from the arm with the AV fistula.
b. The nurse should contact the HD nurse to obtain a specimen from the AV fistula.
c. The blood should be left uncollected until the patient is in HD.
d. The nurse or another phlebotomist should try to obtain the specimen from the unaffected arm.

Check Your Understanding Questions

1. When a patient has peripheral edema, what assessment indicators suggest that administering a diuretic is contraindicated?
2. What fluid and/or electrolyte imbalances might stimulate the RAAS?
3. Why is it important for the nurse to check vital signs trends when considering a patient's fluid volume status?
4. Why might a patient with hypocalcemia and a patient with hypercalcemia both take a bisphosphonate?
5. Why are anticholinergic medications used for urge incontinence and cholinergic medications used for overflow incontinence?

Reflection Questions

1. The nurse overhears another nurse interviewing a patient during an assessment ask, "You don't drink too much alcohol, do you?" What should the nurse do?
2. The patient is due for a dose of midodrine (ProAmatine), a vasoconstricting medication to treat a patient's orthostatic hypotension. As nurse is entering the patient's room to assess their blood pressure before administering the medication, the unlicensed unit assistant states, "I just took his blood pressure; it is 114/68 mm Hg." How should the nurse respond?
3. The nurse is caring for a patient and notices the patient is sweating a lot, requiring frequent linen changes. The patient also had a high fever earlier in the shift. The nurse also notes that the patient has a positive fluid balance of 200 mL at the end of the shift. What should the nurse consider related to the patient's fluid balance?
4. If a patient is receiving medications through his PIC but he refuses to have the PIC changed because "it works fine," what options does the nurse consider?
5. It is well known that IUCs cause CAUTIs, so why is it acceptable to use IUCs at the end of life?

Critical-Thinking Questions about Case Studies

1. Refer to Unfolding Case Study #3: Part 9.
   Explain the pathophysiologic mechanism causing the patient's edema.
2. Refer to Unfolding Case Study #3: Part 10.
   What skin assessments should the nurse perform to confirm the presence of a fluid imbalance?
3. Refer to Unfolding Case Study #3: Part 11.
   Why do you think the provider ordered furosemide instead of a potassium-sparing diuretic for this patient?

What Should the Nurse Do?

1. The nurse is caring for a patient who was recently admitted from the emergency department after involvement in a motor vehicle accident. The patient sustained a crush injury to her pelvis, a mild concussion, and several extremity contusions. The patient's blood pressure is 94/74 mm Hg, heart rate is 120 bpm, respiratory rate is 26 breaths/min, and SpO_2 is 90 percent on room air. What additional assessment data can the nurse obtain to assist in determining what is most likely causing this patient's altered vital signs?

Competency-Based Assessments

1. The nurse is asked to start an IV line at noon and begins infusing 0.9 percent normal saline at 100 mL/h. The patient drinks a cup of juice and consumes a popsicle that has 45 mL of fluid for lunch. At 1530, the nurse assists the patient to the restroom, where she urinates 350 mL of yellow urine. What is the nurse's calculation of the patient's fluid status at 1600?
2. The nurse is caring for an 89-year-old patient who has just experienced open-heart surgery and has a large bandage covering the chest area. How should the nurse assess skin turgor?

3. The nurse is assisting a hospitalized patient who is under a fluid restriction due to an acute kidney injury to decide when to drink fluids throughout the day. The patient has a 1,200 mL/d fluid restriction. The patient is receiving 50 mL of IVF with his antibiotics three times a day. If he wants to equally spread out his fluid intake, how many milliliters can he drink with each meal and with a bedtime snack?
4. The nurse is assessing a patient who has a PIC. The patient has generalized edema in the same extremity where the PIC is located, and the nurse is struggling to tell whether the catheter is in the vein. What steps does the nurse take?
5. A nurse is preparing to give a patient potassium chloride (e.g., K-Lyte) 20 mEq as an oral tablet. The nurse evaluates the patient's serum laboratory results and notices the patient's serum potassium level is 4.8 mEq/L. What other information does the nurse assess to determine whether to administer this medication?
6. Review the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 20

Psychosocial Assessment

FIGURE 20.1 A nurse's proficiency in psychosocial assessment is vital to providing holistic, patient-centered care. (credit: modification of work "Sailor treats a patient aboard USNS Comfort after a medical evacuation" by Stephane Belcher/U.S. Navy/Flickr, CC BY 2.0)

CHAPTER OUTLINE

20.1 Mental Health Assessment
20.2 Substance Use Disorder Assessment
20.3 Abuse and Neglect Assessment

INTRODUCTION A psychosocial assessment is an essential component of the nursing assessment process where the nurse evaluates patients for potential psychological or social risks and identifies opportunities for improvement through various treatment modalities. This assessment allows the nurse to gain insight into the patient's needs, resulting in tailored, patient-centered care and identification of appropriate interventions and resources to assist the patient in improving their situation. The assessment also helps nurses understand how they may best support patients during recovery.

20.1 Mental Health Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Analyze the components of a health history specific to mental health
- Recognize factors that could influence a mental health assessment
- Describe different components of a mental status examination
- Identify the nurse's role in conducting a mental health assessment

When assessing a patient's overall mental health, begin by evaluating their current mental status. As a nurse performing a mental health assessment, you will collect data that is subjective and objective. The nurse observes

the patient's behavior, mood, speech, and thought processes as objective assessment components. Objective data about a patient are measurable and collected through direct observation. Subjective data are not directly measured or observed. Instead, they are gathered during the nursing interview with the patient as the primary source. Other people in the patient's life, such as family and other members of the healthcare team, can be secondary sources of subjective data.

Components of Health History Specific to a Mental Health Assessment

A mental health assessment is a part of the patient assessment. The information gathered during the interview helps the nurse understand how the medical and psychosocial components of a patient's health fit together. Among these components are the patient's personal mental health history, their family mental health history, and any current or past treatment for mental illness. The nurse would also assess the patient for any current signs or symptoms of mental health conditions, such as depression, anxiety, and suicidal idereal rnation.

The nurse collects objective data through direct observation and measurement. Common examples of objective data would be physical exam findings, vital signs, and laboratory test results. Subjective data are not directly measured. Instead, they are actively shared by the patient. For example, the nurse may ask the patient to talk about the symptoms they've been having. The patient's response, which may include their thoughts, feelings, and perceptions, would be considered subjective data.

Previous Mental Health Illnesses

When the nurse is assessing a patient's current mental status, verifying the patient's history of mental illness is essential. This step assists the nurse in discovering factors that contribute to the patient's mental state.

However, the nurse cannot rely only on the patient's report to confirm that the information is accurate and current. For example, it would be easy for a patient to misremember the name of a prescribed medication or confuse the names of a diagnosed condition. The nurse uses medical records and clinical documentation in the electronic health record (EHR) to confirm the patient's medication, diagnosis, treatment, and providers.

The patient's past mental health also does not replace a current assessment. While establishing a patient's history is a necessary step in the process, the nurse must consider it in the context of the patient's current state of health. The nurse assesses the patient's presentation and symptoms but can use any relevant history to inform management approaches.

Patients with a diagnosed mental illness could be more susceptible to triggers that could cause them to relapse or their symptoms to worsen. For example, patients previously diagnosed with bipolar disorder may experience episodes of mania or depression triggered by stress, hunger, fear, confusion, or a lack of sleep. During a mental health assessment, the nurse could find this patient in a manic episode or a depressive state. A mental health assessment could be compromised by a patient's current symptoms, making it challenging to get a clear picture of their day-to-day symptoms. For example, an inability to obtain information could be due to poor communication from the patient. Understanding a patient's past experiences with mental illness, including any psychiatric and/or anxiolytic medications or other treatment they have tried, can help the nurse determine the interventions that have worked well previously and those that have not had the desired effect.

It is also important to note that some people experiencing mental illness have difficulty adhering to a medication or treatment regimen. Weight gain, abnormal body movements, and feeling like they are always sleepy are just some of the reasons patients stop taking their medications. They might even cease psychiatric therapy all together. This interruption in the treatment regimen will cause their mental health symptoms to return and possibly spiral the patient into a severe mental health episode. Nurses play an important part in working to improve medication compliance and adherence to the treatment plan as a whole. Nurses can encourage patients to speak about any difficulties adhering to both the medication and treatment plans. Nurses work closely with all members of the interdisciplinary team and can provide interventions or suggestions to address the patients' concerns and provide support.

When a patient has been hospitalized previously for mental illness, they are at high risk for future readmissions. These patients experience more barriers to accessing care due to cost, stigma, or noncompliance. The nurse should carefully assess these patients for their current level of functioning, overall physical and mental well-being, and identification of any risk factors for self-harm or thoughts of harming others.

Alcohol and Substance Abuse History

A thorough assessment for substance abuse includes detailed notes, including the type, amount, frequency, and consequences of the patient's current or previous drug use. Their use of prescription medications and readiness to change their behavior are also critical components of the nurse's assessment. The nurse may begin by asking the patient broad questions, such as, "Tell me your story and what brings you here today." This gives the patient an opportunity to share openly in an environment of mutual respect and safety. If the nurse needs further information, the questions can become more focused, such as, "Tell me about your history with alcohol and drugs." This allows the patient to open up about their habits and their history. A complete investigation of drug and alcohol abuse will be covered later in this chapter.

LINK TO LEARNING

The nurse should be able to distinguish between symptoms of a drug overdose and other mental health symptoms. The National Institute on Drug Abuse provides a wealth of information about illicit drugs and their effects (https://openstax.org/r/77IllicDrugInfo) including drug and addiction facts.

Family History of Mental Illness

During the mental health assessment, the nurse should determine if the patient has a family history of mental illness, which provides insight into the patient's risk factors for developing mental health conditions. Depression, anxiety, bipolar disorder, and schizophrenia each have a genetic component, meaning that people in the family are at a higher risk of developing the same disorder. Including this information in a nursing assessment assists in creating a personalized plan of care.

Developmental History Related to Mental Illness

From childhood to adolescence, young adulthood, middle age, and beyond, a patient's age and developmental stage are also relevant to their mental health. For example, the nurse needs to understand how mental health conditions may present differently in children versus adults, or the criteria for assessing a younger patient versus an older one.

Considering the patient's stage of life is also necessary because aspects of the aging process may influence their mental health. As people get older, they will experience bodily changes as well as brain changes. For some people, this may include cognitive disorders such as dementia, or mood disorders such as depression and anxiety.

Experiences at certain stages of development also influence a patient's mental health later in life. For example, people who were diagnosed with mental illness in their youth are at increased risk of accelerated aging, worsening health in later adulthood, and early death (Richmond-Rakerd et al., 2021; Wertz et al., 2021). Understanding the effects of a patient's past and current mental health on their future well-being helps the nurse develop an effective, long-term management strategy.

Social History Contributing to Mental Illness

Social history is not only important for assessing current challenges and barriers that a patient may be facing, but also gives the nurse valuable insight into how a patient's life experiences may have affected their mental health.

A patient's background, living conditions, employment status, education level, and family dynamics all shape and contribute to their mental health. Collecting these data gives the nurse information about the patient's life outside the medical setting and highlights factors that may increase or mitigate risks for developing mental health conditions.

Poverty, unemployment, and lack of access to health care or education are just a few social history factors that can negatively affect an individual's mental health. For example, a patient who has lost their job and is under a great deal of stress could be at risk for increased anxiety and depression, and that risk may be higher if they have a history of mental illness. A patient who does not have the means to access health care and social support may struggle to manage their symptoms effectively, which may lead to worsening mental health over time.

Factors Influencing Mental Health Assessments

While the nurse's goal is to create a complete picture of a patient's mental well-being, there are factors that can

make it more difficult to obtain a thorough assessment. The nurse should be aware of patient factors that can negatively affect the assessment:

- Biological, such as genetics, physical illnesses or injuries, and hormonal imbalances
- Psychological, such as past trauma, personality disorders, and substance abuse
- Social, such as poverty and lack of access to healthcare services, healthy food, and water

The nurse will not always know which factors they will encounter before they begin assessing a patient. Being aware of the potential factors and understanding how they can interfere with the assessment helps the nurse learn to recognize them. It also gives the nurse time to come up with solutions and strategies for dealing with the factors when they do emerge.

Patient Willingness to Participate

Nurses may encounter patients who are unwilling to participate in their mental health assessment. They may have experienced trauma in a previous mental healthcare setting, they could be experiencing barriers to health care, or they could be concerned about the stigma associated with mental illness. The nurse should approach the patient with empathy and sensitivity, especially in these cases, by establishing trust and a rapport with the patient. Listening attentively and showing concern demonstrates that the nurse is interested in the patient's thoughts. Establishing trust with the patient is paramount.

Current Health Status

A patient's physical health can contribute significantly to their mental health, and the effects of this interplay can affect the mental health assessment. The nurse evaluates the patient's current health status for physical health factors, such as conditions and the medications used to treat them, that could be contributing to the patient's mental health symptoms.

It is common for a patient to report symptoms that seem to be related to their mental health but are actually manifestations of physical illness. For example, older adults often experience delirium when they have a urinary tract infection (UTI). During the assessment, they may appear confused or combative and have difficulty expressing themselves. However, in this case, the patient's cognitive symptoms are related to an underlying physical health condition, not a mental health condition. Once the UTI is treated, the delirium often resolves as well.

Older adults are also more likely to be prescribed multiple medications to treat physical health conditions. In some cases, cognitive or mental health symptoms are medication side effects or the result of interactions between drugs. In this case, the patient's symptoms may improve if the drug is stopped or the dose adjusted.

Culture

Patients each bring their own cultural beliefs, values, and expectations to the clinical encounter. A patient's cultural background also influences how they feel about their health and how they approach specific aspects of their care.

During the patient assessment, the nurse must be able to recognize factors such as language and communication practices that could affect their encounter with the patient. For example, while direct eye contact during a conversation is an expectation in many Western cultures, it is not the norm in many Asian cultures where it is viewed as disrespectful (Uono & Heitanen, 2015).

CULTURAL CONTEXT

Cultural Formulation Interview (CFI)

The American Psychiatric Association developed the evidence-based Cultural Formulation Interview (CFI) questions to incorporate cultural assessment into all patients' care, which enhances clinical understanding and decision-making (Aggarwal & Lewis-Fernandez, 2020). The CFI questions are used to clarify key aspects of the presenting clinical problem from the point of view of the individual and other members of the individual's social network (e.g., family, friends, or others involved in the current problem). This includes the problem's meaning, potential sources of help, and expectations for healthcare services. For example, the nurse may ask the patient if any aspects of their life are making it harder for them to address their current problem, such as a lack of social support from family and friends or financial constraints.

Some examples of how a person's culture may affect their mental health exam include the following:

- Every culture approaches mental health care differently. Some cultures attach a stigma to mental health challenges, and people who seek mental healthcare services may be considered weak.
- If a patient requires the assistance of a translator during their evaluation, their perception of the questions and the nurse's perception of the answers may be skewed by the translation process.
- Patients who are new to this country's healthcare system may become easily overwhelmed as they attempt to navigate a new culture and a new healthcare system. Many times, mental health symptoms can be exacerbated by stressful situations.

Nurses must have cultural competence, which is the ability to provide care to patients with a diverse set of values and beliefs, meeting the patients' social, cultural, and linguistic needs. The need to demonstrate cultural competence begins with the nurse's first interaction with the patient, which will often include the assessment. The nurse must be aware that a patient's culture affects many aspects of their life, from their lifestyle and diet to social support and beliefs about illness. The nurse needs to be able to consider these factors within the context of the patient's cultural background. By directly asking the patient to share their cultural beliefs during the assessment, the nurse can gather these key details.

Cultural competence is necessary to ensure the accuracy of the assessment but also serves another important function: helping the nurse establish rapport. The nurse can build trust by showing awareness and understanding of the patient's culture. The nurse may not share the patient's beliefs, but they can reinforce trust by showing respect for the patient throughout their interactions.

CULTURAL CONTEXT

Cultural Manifestations of Common Mental Illnesses

Cultures and communities exhibit and explain symptoms of mental illness and manifest stress in various ways. Nurses should be aware of relevant contextual information stemming from a patient's culture, race, ethnicity, religion, or geographical origin. Maintaining cultural awareness is critical for the nurse to recognize cues during the initial assessment from culturally diverse groups. Culture-specific reactions to stress are known as culture-bound syndromes. For example, *ataques de nervios* is a syndrome reported among Latinx in response to stressful situations and includes symptoms of uncontrollable shouting and trembling, or even fainting spells. Other examples include uncontrollable crying and headaches which are symptoms of panic attacks in some cultures, whereas difficulty breathing may be the primary symptom in other cultures. Understanding such distinctions will help nurses effectively treat patients.

At the center of patient-centered care is practicing cultural humility and inclusiveness. In the 2021 edition of *Nursing: Scope and Standards of Practice*, the American Nurses Association (ANA) established a Standard of Professional Performance called Respectful and Equitable Practice. This standard is defined as "The registered nurse practices with cultural humility and inclusiveness." Cultural humility is "a humble and respectful attitude toward individuals of other cultures that pushes one to challenge their own cultural biases, realize they cannot know everything about other cultures, and approach learning about other cultures as a lifelong goal and process." Inclusiveness is "the practice of providing equal access to opportunities and resources for people who might otherwise be excluded or marginalized, such as those having physical or mental disabilities or belonging to other minority groups."

Marginalized people, including minorities, immigrants, refugees, and people from the LGBTQIA+ community, are often exposed to more stress and are therefore at higher risk for mental illness. These people are also more susceptible to socioeconomic disparities, and they are more susceptible to conditions of poverty. These stressors can worsen existing mental illness and should be considered when completing a mental health assessment.

Health Literacy

Health literacy refers to a patient's ability to access and understand basic health information. A patient's health literacy can affect the outcome of a mental health assessment if the patient is not able to fully understand and use

the information being shared. If the patient does not have the knowledge and understanding, they cannot make informed decisions about their health (Centers for Disease Control and Prevention (CDC), 2022). Once the nurse has assessed the patient's health literacy, they can adapt their delivery of the assessment to accommodate any gaps in the patient's knowledge.

LINK TO LEARNING

The Agency for Healthcare Research and Quality has done extensive research on health literacy and developed Health Literacy Measurement Tools (https://openstax.org/r/77HeaLitMeaTool) to measure aspects of personal health literacy. The Rapid Estimate of Adult Literacy in Medicine Short Form may be used in clinical settings to identify patients with limited literacy.

Low health literacy can be a barrier to getting an accurate patient assessment, as the patient may not understand what the nurse is asking or may provide answers that are incorrect because they lack sufficient knowledge. By breaking down the conversation into simpler parts and guiding the patient through the process of thinking about and describing their current medications, the nurse can get a more accurate assessment.

PATIENT CONVERSATIONS

Obtaining a Medication List from a Patient with a Low Health Literacy

Scenario: Nurse walks into the room preparing to ask the patient about what medications they are taking, as part of their admission patient assessment.

Nurse: I'd like to go over your list of medications. Here in your medical record, it says that you take three medications. I'll list them off and I'd like you to tell me if you are still taking them, okay?

Patient: Sure.

Nurse: Great . . . are you still taking the lisinopril for your blood pressure?

Patient: Um, I'm not sure. Is that the little blue one?

Nurse: No, it's not a blue pill.

Patient: Oh, sorry. I'm not sure what the names of them are. I just put them in my pill organizer and make sure I take them.

Scenario update: The patient expresses confusion and uncertainty about the names of their medications, so the nurse adapts their assessment to the patient's lower level of health literacy.

Nurse: That's okay. Your medical record says you take three different medications every day. Does that match up with your pill organizer?

Patient: Yeah. I put three pills in for each day.

Nurse: Great. I know you said one of them is a little blue one. Can you tell me what shape it is?

Patient: Round. Like a circle.

Nurse: Alright. What time do you take it?

Patient: In the morning.

Nurse: Does it come in an orange bottle you have to pick up from the pharmacy?

Patient: No, it's one I buy myself at the store.

Nurse: Okay, so it's not a prescription for your doctor?

Patient: They told me to take it but said I can buy it. I think the box is blue and white.

Nurse: Do you take it for your arthritis?

Patient: Yeah, in my hands.

Nurse: Okay, that matches up with the medication I see on your list called Aleve.

Patient: Yeah, that's it! Sounds like "relieve."

Communication Barriers

Communication barriers are any factors that interrupt, complicate, or otherwise negatively affect the exchange of information between the nurse and a patient. Communication is integral to providing patient-centered care. In cases where the patient can communicate for themselves, the nurse must ensure that they understand the message that is being conveyed.

Communication barriers can make assessing a patient's mental status difficult. Patients can struggle with communication barriers, including difficulty verbalizing distress, shame over their symptoms, concerns they are "untreatable," difficulty processing information, worries about stigma, physiological barriers, language barriers, cultural barriers, and other psychological barriers.

When a patient has a diminished ability to communicate for any reason, a nurse will find it more difficult to glean pertinent data during an assessment. For example, a patient who is hard of hearing may struggle to hear the questions the nurse is asking or may mishear what is being asked. In this situation, the nurse would need to recognize the barrier and come up with a solution. For example, the nurse may need to speak louder and more slowly, write questions down for the patient to read, or use visual aids (like pointing to a body part on an office chart) to communicate more effectively with the patient.

When a nurse notices that a patient is either having difficulty communicating or comprehending questions, they will need to re-evaluate their assessment method and determine what alternative methods of communication would be appropriate. Involving the patient in the process ensures that they are able to express themselves and fully understand questions.

Current Stressors

When beginning a mental health assessment, the nurse should find ways to minimize stressors on the patient, allowing them to participate fully in the assessment. Patients who are hospitalized often complain of sleep deprivation. The nurse should complete their assessment when the patient is well rested. Hunger is another barrier to a low-stress assessment. Assessing the patient after a meal may improve their outlook and increase compliance.

Other potential stressors can also affect the assessment, many of which are beyond the nurse's control. For example, the patient could be dealing with financial worries if they are out of work and hospitalized. They may be confronting mental health stigma from people in their life and feel confused, ashamed, or frightened—especially if they have an untreated mental illness.

Sex

Research shows that a patient's sex can influence how they perceive their symptoms and communicate them to healthcare providers (Cabral & Dillender, 2021). Studies have found that females report more physical symptoms when discussing depression and anxiety, while males tend to externalize their symptoms with aggression, risky behavior, or substance abuse (Smith et al., 2018).

Sex is also correlated with various mental health diagnoses. Females are much more likely to report suffering from depression and anxiety, and males have a higher prevalence of substance use disorder (SUD) and dangerous behavior (Pattyn et al., 2015). Overall, females and males are equally likely to seek help for emotional problems, but females tend to seek help sooner. Numerous studies reveal that males tend to wait until symptoms are heavily affecting their lives before seeking treatment (Kwon et al., 2023).

Previous Negative Experiences

When a patient has a history of negative experiences in health care, it can be difficult to assure them that they are safe to share and participate in the nurse's assessment. The nurse should give each patient enough time to express their fears and concerns. For example, if a patient has a history of bipolar disorder and in childhood received

frightening treatment that did not seem to improve their symptoms, they may be less trusting of revealing information to the nurse and less inclined to seek help or participate in improving their mental health. This is when the nurse's reassurance and encouragement come in.

A patient may also be facing stigma and shame surrounding a mental health diagnosis, either from outside the healthcare system (e.g., family) or through their interactions and experiences with other providers. The nurse needs to be aware of the broader societal stigma around mental illness and ensure they are not intentionally or unintentionally promoting it. This means paying attention to not only the language they use to talk about mental health, but also their responses (both verbal and nonverbal reactions) that communicate sentiment to the patient when they are confiding in the nurse.

Nurse's Attitude or Approach

The way a nurse approaches the patient lays the foundation for how their assessment will unfold. This is especially true for patients experiencing a disturbance in their mental well-being. For this reason, the nurse should take extra care to approach the patient with empathy, understanding, and kindness. If the patient is reassured that the nurse is not there to judge them but to help, they will likely be more cooperative in their assessment.

REAL RN STORIES

It's All in the Approach

Nurse: Barb, RN
Clinical setting: Medical/surgical floor in a level 1 trauma center
Years in practice: 16
Facility location: Kansas City, Missouri

I was a nurse on a busy medical/surgical floor with six patients to care for this particular day. In report, I was informed that Mrs. Baker in room five had been treated for kidney stones, and her symptoms have resolved, but she is displaying some additional behaviors that could be related to either a side effect of some of her new medications or a mental health disorder. Mrs. Baker is an 84-year-old female who lives alone and has no family. She had been experiencing visual and auditory hallucinations since her admission three days earlier with kidney stones. Her husband Robert passed away more than ten years ago, and the rest of her family lives out of state. After finishing report, I go into the room and introduce myself to Mrs. Baker. I'm surprised to find her having a pleasant conversation with an empty chair.

"Oh, Robert," Mrs. Baker laughed, "I love it when you read poetry to me."

I approach her quickly because I'm in a hurry, telling her, "Honey, there's no one there. You're talking to an empty chair. Do you talk to furniture at home?"

Dejected and embarrassed, Mrs. Baker became confused and tearful, getting back into bed and pulling the blankets over her face. She refuses to talk to me at all. I mumbled under my breath that I don't have time for this, and with frustration I tell Mrs. Baker, "I'll be back to check on you later." Within the next hour, a new admission arrives on the floor, so Mrs. Baker is reassigned to a different nurse named Terry. Terry had experience working with older adults and had also worked in a behavioral health hospital before transitioning to this hospital. When she took report from me, she knew exactly what Mrs. Baker needed. Terry gathered a bouquet of flowers that a departing patient had left and walked toward Mrs. Baker's room. Terry asked her permission to enter the room to sit and talk with her. She seemed touched that a nice man had brought her flowers. Terry explained to Mrs. Baker that at the hospital, the staff are concerned with every level of their patients' health. Terry also told her that while her physical symptoms have gotten better, she wanted to ask her some questions to see if there is anything else we might be able to do to help her.

When met with Terry's easygoing, honest approach, Mrs. Baker was happy to comply. I learned from Terry that nurses must remember to meet patients where they are. Nurses should take a moment to get to know their patients and proceed only when they have established trust.

Conducting a Mental Status Examination

Registered nurses must use effective clinical interviewing skills to assess a patient's mental status and develop a therapeutic nurse-patient relationship. Assessing a patient with a suspected or previously diagnosed mental health disorder focuses on both verbal and nonverbal assessments. The subjective data are data a patient actively shares with the nurse, including data about signs and symptoms. The objective data are data the nurse collects through direct observation. Compare new assessment findings to the baseline admission findings to determine if the patient's condition is improving, worsening, or remaining the same.

The mental status examination is a priority component of a comprehensive patient evaluation. Many successful nurses perform the bulk of the mental status examination through unstructured observations made during the routine physical examination. A **mental status examination** assesses a patient's level of consciousness and orientation, appearance and general behavior, speech, motor activity, affect and mood, thought and perception, attitude and insight, and cognitive abilities, some of which will be covered here in more detail.

LINK TO LEARNING

Learning how to master mental health examinations takes time and determination. Many nursing students may not get the opportunity to spend a lot of time observing and practicing mental health assessments. These free virtual games (https://openstax.org/r/77FreeVirtGames) help nursing students learn specific ways to assess many mental health disparities.

Generalized Behavior and Motor Assessment

A mental health assessment has some elements of a complete assessment. During a complete physical assessment, the nurse observes that the patient is awake, alert, and oriented to person place, time, and situation. The patient's general appearance and behavior is also noted. A mental health assessment is a more in-depth assessment of the patient's' appearance, behavior, and demeanor (Table 20.1). While the patient may report some symptoms (subjective data), the nurse also needs to pay attention to objective data that can be observed by listening and watching carefully.

Element	Objective Assessment
Hygiene	• Is the patient clean, or are there signs of not bathing or washing their hair? • Are their teeth brushed, or do they seem to set aside oral care? • Are nails clean and clipped, or are they long, ragged, or dirty?
Grooming	• Is the patient's hair combed, or is it disheveled? • Do they have body odor?
Dress	• Do the patient's clothes match, and are they clean and well-fitting? • Do their shoes match, and are the laces tied, or are they dragging on the floor?
Eye contact	• When you speak to the patient, do they make eye contact, or is it difficult for them to look you in the eye?

TABLE 20.1 General Assessment of Behavior (Source: Finney et al., 2016.)

Element	Objective Assessment
Mannerisms	• Does the patient's body posture seem unusual (rigid or slumped)? • Do they rock back and forth rhythmically? • Do they move in jerky movements? • Do they have a tremor?
Interpersonal behaviors	• Is the patient able to have a conversation with you? • Do they acknowledge your presence? • Are they talking to anyone who is not present? • Are they talking to inanimate objects?

TABLE 20.1 General Assessment of Behavior (Source: Finney et al., 2016.)

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Performing a Situational Assessment

See the competency checklist for Performing a Situational Assessment. You can find the checklists on the Student resources tab of your book page on openstax.org.

Mood and Affect

A short-lived emotional state that can change based on emotion is known as **mood**. Mood can be described using terms such as *neutral* or *elevated*. It can also be described as anxious; angry; sad; irritable; **dysphoric**, exhibiting depression; or **euphoric**, a pathologically elevated sense of well-being. Sustained emotions influence a person's behavior, personality, and perceptions.

The term **affect** refers to the patient's expression of emotion. People may express feelings of emptiness, impaired self-esteem, or indecisiveness, or they may have crying spells. Normal affect and mood are described as **euthymic**, which means that an individual displays a wide range of emotions that are appropriate for the situation. Abnormal findings related to affect include inappropriateness for the situation, like laughing at the recent death of a loved one, or incongruence. Consistency between verbal and nonverbal communication is known as **congruence**. A patient's expression of emotion may also be described as follows:

- **broad affect**: emotions are expressed in a healthy, appropriate manner
- **inappropriate affect**: emotional responses that are not appropriate for the situation
- **subdued affect**: minimal emotion, lack of spontaneity, withdrawn, unmotivated
- **tearful affect**: quick to cry, vulnerable, easily overwhelmed
- **labile affect**: varying and suddenly shifting emotions
- **blunted affect**: diminished range and intensity
- **restricted affect**: reduced emotional expression and intensity, which can be expressed in depression, inhibited personalities, and schizophrenia
- **flat affect**: no emotional expression

Emotions and Attitude

The patient's attitude is the emotional tone displayed toward the examiner, other individuals, or their illness. It may convey a sense of hostility, anger, helplessness, pessimism, overdramatization, self-centeredness, or passivity. Determining the patient's attitude toward emotional problems or diagnosed mental health disorders is essential. Does the patient look forward to improvement and recovery or are they resigned to suffering?

Expressions

Emotions and facial expressions are congruent in most individuals. When a person feels joyful, they generally wear a smile and have a pleasant countenance. When a person is sad, their facial expression often conveys their sadness to others. When a person is experiencing mental illness, however, they may be experiencing one emotion while their

affect and body language tell another story. The term **mood congruence** is the consistency between the patient's emotional state and their affect. When assessing a patient's mental health, the nurse should note any mood incongruence between their facial expressions and current emotions.

Depression

Depression differs from the usual mood fluctuations and short-lived emotional responses to everyday stressors. When it is recurrent with moderate or severe intensity, depression can become a serious health condition that causes the affected person to suffer greatly and function poorly at work and school. Depression can also adversely affect relationships with family and friends. At its worst, depression can lead to suicide.

Anxiety

Anxiety presents as a general nonspecific discomfort with feelings of vulnerability and, often, impending doom. Individuals experiencing anxiety feel extreme worry and threat about scenarios that might happen. Symptoms of anxiety can include the following:

- increased blood pressure
- sweating
- trembling
- increased respiratory rate
- tachycardia
- nausea and vomiting
- muscle tension
- diarrhea
- flushing
- dry mouth
- pupil dilation
- clammy skin
- impaired normal function
- urinary frequency

Thought Process and Content

The way a patient perceives and responds to stimuli is a critical part of a mental health examination. For example, does the patient harbor real concerns or have their concerns escalated to become irrational fear? Are the patient's responses exaggerated compared to actual events? Is there no discernible basis in reality for the patient's beliefs or behavior? Patients with mental health disorders may experience intrusive thoughts, delusions, and obsessions.

A patient's thought processes may also affect the outcome of a mental health assessment. If the patient utilizes **abstract thinking**—the ability to think about objects, principles, or ideas that are not physically present—the assessment will yield more helpful information, as the patient can discuss occurrences beyond the here and now. If the patient only displays **concrete thinking**, a literal form of thought, they will take in all the information they can see, hear, or touch at face value and have difficulty applying it beyond the present. In each of these scenarios, the outcome of the assessment may be affected by the patient's cognitive process. Nurses should keep this in mind when assessing patients.

Clarity of Ideas

Clarity of ideas, or mental clarity, allows people to process thoughts and abstract ideas. Clarity allows them to work through problems and remain productive. Mental clarity allows people to make decisions confidently and engage in meaningful conversations with others. Those who do not have mental clarity experience confusion, forgetfulness, and difficulty focusing their thoughts. Lack of sleep, stress, and multiple mental disorders can lead to poor mental clarity.

PATIENT CONVERSATIONS

Unregulated Thought Process: Word Salad

Scenario*:* The nurse walks into patient's room to complete a nursing assessment. The patient grows anxious, eyes

wide. She is sitting in the chair by the window, and she turns her head to face the corner.

Nurse: Hello, Ms. Williams, my name is Gabriella, and I'll be your nurse today. I'm going to sit over here [several feet from the patient so she feels less threatened] and ask you some questions, okay?

Patient: Umph. I upstairs by the wanted toaster rhyme with down water noggin tasty rough pack.

Nurse: Okay, Ms. Williams, here's some water. Just relax. No one here is going to hurt you. Are you understanding what I'm saying to you?

[Patient slowly nods head.]

Nurse: Would you please tell me your name and date of birth?

Patient: After I wanted down to pickles and objects fast cars with pudding, nightmares, funny little friends. Can't get there from walnut pickers.

Nurse: One more thing, Ms. Williams, can you hold up three fingers for me?

[Patient slowly holds up three fingers.]

Scenario follow-up: The nurse needs to evaluate the patient's communication and comprehension, as well as overall demeanor. When the nurse enters the room, the patient is anxious and hesitant. As the nurse questions the patient, it becomes clear that the patient is struggling to communicate; her words are nonsensical. When asked if she understands, the patient's nonverbal communication (nodding her head) conveys that she does. However, her verbal communication to the nurse continues to be a string of random words. The nurse adjusts the assessment by asking the patient to demonstrate her understanding nonverbally (holding up three fingers), which the patient is able to do. Through observation, the nurse has determined that although the patient is struggling to communicate and produce coherent speech, she appears to be able to comprehend what is being said to her.

Impulse Control

Nurses can evaluate a patient's impulse control by asking the patient if they ever become involved in activities without first planning them. An example of this would be a patient buying a last-minute airline ticket overseas without first considering their job, family responsibilities, or the financial expenditure of such a trip. Patients with poor control of impulses may have a weakened ability to control temptations or urges. Poor impulse control is seen in various disorders, including substance abuse, disordered eating, risky sexual behavior, pathological gambling, antisocial personality disorder, bipolar disorder, schizophrenia, and impulse control disorder.

Thoughts of Self-Harm

While any patient may experience thoughts of self-harm or engage in self-harming behaviors, those who have mental illness such as severe depression or who are experiencing stress and trauma are at especially high risk. Patients with altered perceptions, particularly if they are experiencing hallucinations and delusions, may also have violent thoughts that are directed at themselves or others. If a patient has auditory hallucinations, the nurse must determine if the voices encourage them to hurt themselves or others. A person experiencing **suicidal ideation** has been thinking about suicide but does not necessarily have the intention to act on that idea. A person who has attempted suicide harms themselves with the intent to end their life but does not die. A person with a suicide plan has a plan to die by suicide, the means to injure themselves, and intends to die. Everyone can help prevent suicide by recognizing warning signs and intervening appropriately. In addition to encouraging these general action steps (Figure 20.2) to prevent suicide, nurses can further prevent suicide by establishing a safe care environment. Establishing a safe care environment is a priority nursing intervention.

FIGURE 20.2 These suicide prevention action steps help start a conversation that could save a life. (credit: National Institute of Mental Health, Public Domain)

CLINICAL SAFETY AND PROCEDURES (QSEN)

Competency: Clinical Safety and Procedures

Definition: Minimize risk of harm to patients and providers through both system effectiveness and individual performance. The nurse will:

- Identify risk factors and protective factors.
- Discuss a suicide assessment.
- Determine risk levels and interventions.
- Document a treatment plan.

Every year, more than 700,000 people die by suicide (World Health Organization, 2023). The nurse needs to be aware of the risk factors and protective factors that can affect a patient's risk for suicide.

Examples of risk factors that may make suicide more likely include mental health conditions, trauma, previous suicide attempts, lack of social support, social isolation, substance abuse, and access to the means to die by suicide (such as having weapons in the home).

Patients with the following symptoms are more likely to be at a risk for suicide (CDC, 2024):

- feeling like a burden
- being isolated
- increasing levels of anxiety
- feeling trapped
- being in unbearable pain
- increasing substance use
- seeking access to lethal means
- increasing anger or rage
- exhibiting hopelessness
- sleeping too little or too much
- talking about wanting to die
- making plans for suicide
- exhibiting extreme mood swings

The nurse needs to understand the barriers to effective care for depression, which include a lack of resources, a shortage of trained healthcare providers, and social stigma associated with mental health disorders.

Protective factors, which make suicide less likely, include having access to health care and mental health treatment, social support, effective coping skills, close relationships, and limited access to means to attempt or die by suicide. Protective factors help reduce the risk of suicide, but do not eliminate it. A patient may appear to have several protective factors and few risk factors if they are trying to conceal their distress or suicidal intent. While the nurse needs to be able to recognize the warning signs of suicide, they also need to be aware that some patients who are having suicidal thoughts may not show these signs.

LINK TO LEARNING

Visit the Suicide Prevention Resource Center's webpage to read more about the Patient Safety Screener: A Brief Tool to Detect Suicide Risk (https://openstax.org/r/77PatSafScreen) to help assess suicide risk. The tool is appropriate for youth and adults. Most people who die by suicide have visited a healthcare provider within months before taking their lives. This presents an opportunity to screen and identify patients at risk and get them connected with the appropriate resources.

Thoughts of Harming Others

Threats or acts of life-threatening harm toward another person is known as **homicidal ideation**. When a patient states that they are experiencing homicidal thoughts, it merits thorough exploration. The nurse's goal in assessing them should be as follows: recognize and detect risk factors, then perform a thorough screening focused on the patient's current homicidal ideation. Determine whether they have a plan in place and the means to carry out the plan. Do they intend to carry out their plan? Also, look into the patient's history to find out if they have a history of injuring or killing others. Determine the current risk, then develop and fully document an intervention plan that is collaborative and appropriate for the level of risk.

Unusual or Bizarre Beliefs

Patients experiencing mental illness often exhibit alterations in cognitive functioning. Many times, patients do not realize that their thought processes are altered. A thorough mental health assessment will assist in zeroing in on these symptoms to determine the best treatment. Unusual or bizarre beliefs can develop as coping mechanisms to deal with mental illness, or they can appear on their own as a result of mental illness. Some examples of unusual or bizarre beliefs may include a patient's belief that the government is reading their mind or the belief that world events have something to do with them personally (Table 20.2).

Cognitive Function	Alteration or Bizarre Beliefs
Lack of insight	A person is unaware of their mental health diagnosis and/or is not able to understand the need for treatment (anosognosia).
Thought content	A person's thoughts are distorted, disorganized, and/or irrational (e.g., delusions, magical thinking).
Thought broadcasting	A person believes their thoughts are broadcast to the public through the radio or television.
Thought insertion	A person believes their thoughts are being forced into their mind from external sources.
Thought withdrawal	A person believes their thoughts are being removed from their mind by another person or entity.
Thought blocking	A person's flow of thought or speech is suddenly interrupted and they are aware that they cannot complete a mental activity (for example, they are unable to find the right words when having a conversation).
Neologism	A person uses new, unrecognizable words with unknown origins; often seen in schizophrenia.
Ideas of reference	A person falsely believes that world events and innocuous occurrences could have vital personal significance.
Flight of ideas	A person has erratic thoughts and rapid speech that could be a symptom of a manic episode in bipolar disorder.
Loose associations	There is a lack of connection between ideas.
Word salad	A person has severely disorganized and virtually incomprehensible speech or writing marked by a severe loosening of associations.

TABLE 20.2 **Unusual or Bizarre Beliefs** (Source: Mental Health Coordinating Council, 2015.)

Delusions or Hallucinations

Patients may also experience altered perceptions, such as hallucinations and delusions. False sensory perceptions, or **hallucinations**, not associated with actual external stimuli and can include any of the five senses (auditory, visual, gustatory, olfactory, and tactile). For example, patients may see spiders climbing on the wall or hear voices telling them to do things. These are "visual hallucinations" or "auditory hallucinations." A **delusion** is a fixed, false belief not held by cultural peers that persists despite objective contradictory evidence. For example, a patient may have a delusion that the CIA is listening to their conversations via satellites.

Nurses must remember that delusions and hallucinations feel real to patients and cause internal emotional reactions, even when a caregiver reassures patients that the delusions are not based in reality. Because patients often conceal these experiences, it is helpful to ask leading questions, such as, "Have you ever seen or heard things that other people could not see or hear? Have you ever seen or heard something that later turned out not to be there?"

Psychomotor Activity

Take note of overall motor activity, including any tics or unusual mannerisms. Normal motor activity refers to the patient having good balance, moving all extremities equally bilaterally, and walking smoothly. Slow movements or lack of spontaneity in movement can occur due to a physical condition affecting movement, side effects of medications, as well as mental health and cognitive disorders such as depression or dementia. Uncontrolled, involuntary movement, or **dyskinesia** and **akathisia** (motor restlessness) may occur if the patient is experiencing extrapyramidal syndrome related to psychotropic medication use. Nurses may note **psychomotor agitation**, which is a condition of purposeless, non-goal-directed activity; or **psychomotor retardation**, a condition of extremely slow physical movements, slumped posture, or slow speech patterns. In some cases, patients will present in a catatonic or near-catatonic state. Waxy flexibility, or **catalepsy**, or , is a state of continued unresponsiveness where the patient may remain in a fixed body posture for extended periods.

Cognition

Cognition is the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses. It includes thinking, knowing, remembering, judging, and problem-solving. When performing mental examination on cognition, the examiner assesses several functions, including orientation, attention, language, and memory. The nurse may also assess the patient's thought content, executive function, motor function, and spatial awareness.

A term related to assessing attention is **distractibility**, referring to the patient's attention being quickly drawn to unimportant or irrelevant external stimuli. A patient with normal cognition can generally exercise appropriate **judgment**, which refers to one's ability to recognize relationships, draw conclusions from collected evidence, and evaluate people and situations. Another valuable insight that may come out during the assessment of cognition is the patient's **self-concept**, or their evaluation of themselves, which includes physical and psychological attributes.

Orientation

The first step in the cognition status part of the exam is to assess the patient's orientation. Is the patient alert and oriented? Nurses evaluate patients' orientation to person, place, time, and event. If the patient is alert and oriented to person, place, time, and event, the chart will often note, "Patient is A&Ox4."

Orientation, or the lack thereof, is sometimes evident in regular conversation with patients, but to obtain a proper evaluation, ask patients the four following questions:

- "Would you please tell me your full name?"
- "Where are we today?"
- "Can you tell me the date? Or the day of the week?"
- "Who is the President of the United States?" or "Why are we here today?"

Attention Span

Patients who are easily distracted will often lose their train of thought and forget what they say when speaking. This is noteworthy in your assessment. A disorganized thought process and a reduced ability to focus attention on the subject at hand is known as **tangential thinking**. People experiencing this type of thought disturbance include excessive or irrelevant details in conversations and have difficulty reaching the main point in their conversations. Another type of distracted thinking is **circumstantial thinking**, or when a person's speaking and thought process strays from the original topic before returning to the initial subject.

Memory

Patients who present with poor attention spans will often experience memory problems as well. Memory disturbance is a common complaint and is often a presenting symptom in older adults. Memory can be grouped into immediate recall, short-term memory, and long-term memory. Short-term memory is the most clinically pertinent, so evaluating is essential. Short-term retention requires that the patient process and store information to move on

to a second intellectual task and then call up the remembrance after completing the second task. For example, short-term memory may be tested by having the patient repeat the names of four unrelated objects and then asking the patient to recall the information three to five minutes after performing a second unrelated mental task.

The term **remote memory** refers to memories in the patient's distant past. Many people who are experiencing short-term memory problems are still able to recall remote memories, such as the names of childhood playmates and teachers, old commercial jingles, and song lyrics. These memories are stored in a different area of the brain than recent memories and may be easier to access. To evaluate long-term or remote memory, the nurse should ask the patient about personal life events or ask them to recite a poem or sing a song they know.

Patients experiencing a remote memory deficit may be able to learn new information but have difficulty remembering things that happened in the past. When remote memory is impaired, it can be a challenge to determine the root cause. A patient experiencing remote memory dysfunction may be experiencing dementia or Alzheimer disease, brain tumors, blood clots, a brain infection, thyroid, liver or kidney disease, overconsumption of alcohol, a head injury, or medication side effects.

New Learning: The Four Unrelated Words Test

The Four Unrelated Words Test is a way the nurse can assess the patient's ability to form new memories by testing their immediate and delayed recall. The findings from the unrelated word test can help the nurse assess the severity of the patient's cognitive impairment and determine whether they may benefit from interventions such as memory aids.

PATIENT CONVERSATIONS

Performing the Four Unrelated Words Test

Scenario: The nurse enters the room to perform the Four Unrelated Words Test on a 76-year-old patient, Mr. Conrad, who has shown signs of mild cognitive impairment.

Nurse: Mr. Conrad, I'm going to tell you four words and I want you to repeat them back to me, okay?

Patient: Okay.

Nurse: Apple, pillow, fox, yellow.

Patient: Apple, pillow, fox, yellow.

Scenario follow-up: By asking the patient to repeat the words right away, the nurse has assessed their immediate recall. Mr. Conrad has successfully remembered all four words correctly. Now, the nurse needs to test the patient's delayed recall.

Nurse: Great. Now, we're going to do a different task, but I want you remember those words, okay?

Patient: Okay.

Scenario follow-up: The nurse engages the patient in an unrelated task, like counting, for approximately five minutes. Afterward, the nurse asks the patient to recall the four words.

Nurse: Mr. Conrad, can you tell me those four words?

Patient: Um . . . apple . . . fox . . .

Nurse: Can you remember the other two?

Patient: One was a color, I think?

Nurse: Yes, one was a color.

Patient: ... was it yellow?

Nurse: Yes, that's correct. Do you remember the fourth word?

Patient: No, I don't. I don't know what it was.

Scenario follow-up: Here, the patient was able to recall two of the four words, and a third word with a hint. They were not able to come up with the fourth word. The nurse records the patient's performance on the memory task and may retest them again at ten and thirty minutes.

The Nurse's Role in Conducting a Mental Health Assessment

The nurse plays an important role in the mental health assessment by collecting, organizing, and analyzing data. They will use the information gathered to develop a nursing diagnosis and present their findings to the patient's interdisciplinary team to discuss treatment. Based on the findings from the full mental health assessment, the nurse may consider other options for psychological testing (Table 20.3).

Test Name	Description
Mini-Mental State Exam (MMSE)	An easily performed test that is the precursor to more advanced testing and provides insight into the patient's current mental status
Beck's Depression Inventory	A twenty-one-question test for evaluating a patient's current level of depression
The Cornell Depression Scale	A geriatric version of Beck's Depression Inventory that can be used in people with dementia
Beck's Scale for Suicide Ideation	Used to screen for suicide risk in children and adolescents
Harkavy-Asnis Suicide Scale	Used to screen for suicide risk in children and adolescents
Suicidal Behaviors Questionnaire for Children	Used to screen for suicide risk in children and adolescents
Geriatric Depression Scale	Used to screen older adults for depression

TABLE 20.3 Common Psychological Tests

Collecting Data

Collecting data during psychological testing consists of conducting patient interviews as well as administering a psychosocial assessment, a mini-mental exam, or other appropriate tests. The nurse also reviews the patient's medication list and screen for suicidal or homicidal ideation. The patient will be assessed for exposure to trauma, violence, and substance abuse (Lengel & Tortorice, 2022).

Gathering these data helps the nurse establish a baseline that will inform the remainder of the assessment. The information collected helps the nurse begin to create an accurate picture of the patient's current state as well as any past factors that might be influencing their mental health.

During the data collection phase, the nurse also supports the patient by evaluating their ability to participate in the assessment and adjusting their questions accordingly to ensure that the patient is able to communicate and be heard.

Organizing Data

A nurse will likely have a framework, such as an electronic health record, to organize their data. Once the nurse has collected all the pertinent data, they should be entered into the patient's chart so the interdisciplinary team can access the most recent, relevant information. All material should be organized and validated before putting it in the patient's chart.

Analyzing Data

Data analysis is the stage where the nurse views all collected data and draws conclusions based on them. During this phase, the nurse should assemble the data, develop findings, develop conclusions based on the findings, and develop recommendations for patient care. Validation is the processing of all data by the nurse to be sure it is factual and accurate.

Developing Nursing Diagnosis and Planning

Nursing diagnoses are customized to each patient and drive the development of the nursing care plan. Some examples of nursing diagnoses related to mental health may include (1) disturbed thought process related to psychological barriers as evidenced by inappropriate social behavior or (2) ineffective coping related to inadequate resources as evidenced by inability to ask for help.

Once the diagnosis component is complete, the next step in the nursing process is planning for the patient's treatment. The data that the nurse have gathered and analyzed, along with their knowledge of current practice, are used to develop evidence-based strategies that address the patient's needs. The nursing interventions are documented in the patient's record so that they are accessible to other members of the care team.

Implementing

Implementation begins after the patient receives a medical diagnosis and a treatment plan. Usually, an interdisciplinary team assists in putting together a therapeutic care plan for the patient, which various team members will then carry out.

The nurse is involved in several aspects of the patient's care, as opportunities exist for nursing interventions at every step of the treatment plan. While coordinating care, the nurse may provide the patient with referrals to community support groups, advocate for dignified care with the interprofessional team, and communicate patient trends with the staff. Health teaching and health promotion are important steps in the treatment process where the nurse delivers teaching about self-care, stress-management techniques, and coping strategies. The nurse also provides teaching about medications and their mechanisms of action, intended effects, potential adverse effects, and ways to cope with side effects. In group therapy, the nurse should encourage patient participation. Throughout treatment, the nurse advocates for the least restrictive interventions and environments necessary to maintain patient safety. Nurses in the mental health setting should observe patients for changes in behavior and document changes in patient behavior. By demonstrating caring behaviors and utilizing therapeutic communication techniques, nurses can help a patient feel at ease, allowing them to participate in treatment.

Evaluating Interventions

Evaluation focuses on reviewing the effectiveness of the nursing interventions by comparing the patient's condition with the expected outcomes. Evaluation includes data analysis from assessments, screening tools, laboratory results, pharmacologic interventions, and the effectiveness of nursing interventions.

During the evaluation phase, nurses use critical thinking to analyze reassessment data and determine if a patient's expected outcomes have been met, partially met, or not met by the established time frames. The nurse should revise the care plan if outcomes are not met or only partially met.

For example, if a patient's care plan includes cognitive behavioral therapy (CBT) for panic disorder, the nurse will have established goals for the patient during the planning phase and will need to measure the patient's progress toward those goals throughout treatment. The nurse assesses the patient's participation in the intervention and reviews any provider notes. They will also talk to the patient about the treatment and assess for any changes in symptoms or behaviors. For example, the patient may report that since starting CBT, they have experienced fewer panic attacks. Conversely, they may report no change in their symptoms. In either case, the subjective information from the patient about their perception of the intervention's efficacy will need to be documented and considered along with the provider's evaluation of the patient's progress. Together, these data help the nurse determine whether the patient's care plan needs to be adjusted to help them meet their treatment goals.

If a revision is necessary, the nurse should consider which nursing process step requires modification. Have additional assessment data been obtained, or have assessment data changed? Has a different nursing diagnosis become a priority? Were the identified goals or expected outcomes unrealistic? Were any interventions not effective?

Reassessment should occur every time the nurse interacts with a patient, discusses the care plan with others on the interprofessional team, or reviews updated laboratory or diagnostic test results. Nursing care plans should be updated as higher-priority goals emerge. The evaluation results must be documented in the patient's medical record.

20.2 Substance Use Disorder Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Verbalize assessment considerations for identifying alcohol abuse
- Describe assessment measures for identification of illicit drug use
- Describe the nurse's role in substance abuse assessment and management

An umbrella term used to describe the misuse of drugs or alcohol that can lead to severe physical and psychological consequences is **substance use disorder (SUD)**. Misuse of alcohol, drugs, and prescribed medications is estimated to cost the United States more than $400 billion in healthcare expenses, law enforcement and criminal justice costs (due to drug-related crimes), lost workplace productivity, and losses from motor vehicle crashes (U.S. Department of Health and Human Services, 2016). The Centers for Disease Control and Prevention (CDC) National Center for Health Statistics estimates that 107,622 drug overdose deaths and 52,000 alcohol-induced deaths occurred in the United States in 2021. Chronic substance use disorders significantly impact individuals, families, communities, and society. According to the 2020 National Survey on Drug Use and Health (NSDUH), 40.3 million people in the United States aged 12 or older (14.5 percent) have an SUD.

Assessment of Alcohol Use

Assessing a person's use of alcohol is critical to getting them the right level of help. Obtain the following information from a patient:

- history of substance use, including alcohol and illicit drug use
- detailed history of previous withdrawal treatments
- treatment history
- mental health history
- social history
- medical history, including any recent physical symptoms

The patient should receive a comprehensive physical examination to evaluate signs related to current withdrawal symptoms and symptoms of concurrent medical and mental health diagnoses. Assess also for signs of complications, such as liver or pancreatic disease. Several tests are available to determine a person's current relationship with alcohol and whether it is pathological (Table 20.4).

Test	Description
Alcohol Problems Questionnaire (APQ)	Forty-four-question test filled out by the patient, assesses various areas of the patient's life and whether the patient's alcohol use impedes them
Alcohol Use Disorders Identification Test (AUDIT)	Ten-question test that helps a patient estimate their daily use of alcohol
Clinical Institute Withdrawal Assessment of Alcohol Scale (CIWA)	Ten-question survey to be used to monitor and evaluate a patient's withdrawal symptoms

TABLE 20.4 Alcohol Misuse Tests

Test	Description
Leeds Dependence Questionnaire (LDQ)	Ten-question survey that assesses the importance of alcohol or drugs to the patient
Severity of Alcohol Dependence Questionnaire (SADQ)	Twenty-question test that assesses the severity of dependence on alcohol

TABLE 20.4 Alcohol Misuse Tests

Alcohol Use

The nurse needs to assess the patient's alcohol use behaviors. Questioning the patient about how much alcohol they consume (e.g., daily, weekly) can help the nurse determine the patient's risk for alcohol misuse.

A **moderate alcohol use** in a healthy adult is considered one drink daily for women and two drinks daily for men. An example of one drink includes the following:

- wine: 5 fluid ounces
- beer: 12 fluid ounces
- distilled spirits (80 proof): 1.5 fluid ounces

An alcohol use disorder (AUD) is a medical condition characterized by a person's inability to control or stop using alcohol, despite the possible adverse events resulting from their drinking. What was previously referred to as alcohol abuse is now called alcohol use disorder. The severity of AUD—mild, moderate, or severe—is based on the number of criteria met (Grant et al., 2015).

LINK TO LEARNING

The *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)* has established a list of eleven criteria to assist in defining alcohol use disorder (AUD) (https://openstax.org/r/77CriteriaAUD) and its severity.

Clinicians often gauge a person's AUD severity by risk, recommended treatment options, and eligibility for various treatment programs (Table 20.5) (National Institute on Alcohol Abuse and Alcoholism, 2021). Having any one of these symptoms could be a reason for concern. The more symptoms present, the more urgently the patient needs treatment.

Severity	Number of Symptoms Present
Mild alcohol use disorder	Two to three symptoms
Moderate alcohol use disorder	Four or five symptoms
Severe alcohol use disorder	Six or more symptoms

TABLE 20.5 Determining the Severity of AUD

A destructive pattern of alcohol consumption that causes adverse physical, psychological, or social side effects is **harmful drinking**. Alcohol consumption that threatens a person's health, safety, and well-being is considered **at-risk drinking**. It consists of binge drinking, drinking while pregnant, underage drinking, or any other form of potentially hazardous alcohol use. An excessive or dangerous intake of alcohol that leads to considerable impairment in physical and mental health is considered **hazardous drinking**. Inebriation caused by alcohol or other psychoactive substances, resulting in behavioral and physiological changes is referred to as **intoxication**.

When a person begins drinking excessively, they can develop alcohol **dependence**, a complex condition that results in a compulsive, chronic reliance on alcohol for physiological and psychological gratification. Dependence on alcohol is marked by the inability to stop drinking, even if a person wants to quit due to experiencing the symptoms of

withdrawal. Over time, the person can build a **tolerance** to the alcohol, or the physiological capacity to withstand the effects of a substance with repeated use or exposure. In tolerance, the person needs to drink more to get the same effect. The term addiction refers to the changes in a person's behavior, such as seeking out alcohol despite experiencing negative consequences from using it, that come from having developed a dependence on the substance.

In a controlled environment, such as a hospital or treatment center, the treatment staff are available to help the patient eliminate those things working against their recovery and maximize their efforts toward remission. A **controlled environment** is an artificial atmosphere that is carefully regulated and monitored to ensure maximum accuracy and precision. The first milestone in remission is **early remission**, which is when a patient who previously met all the criteria for alcohol use disorder has been sober for three months but less than twelve months. As the patient continues to work through their program, the next milestone is **sustained remission**, which means they have maintained sobriety for more than twelve months.

LINK TO LEARNING

There are several AUD resources available online:

- Guidelines found at Rethinking Drinking (https://openstax.org/r/77RethinkDrink)
- General information from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) (https://openstax.org/r/77NIAAAInfo)
- Treatment resources from the NIAAA Alcohol Treatment Navigator (https://openstax.org/r/77AlcoTreatNavi)

Drinking Measures: Descriptive Information

The nurse has several evidence-based tools that can help them screen patients for risky alcohol use and assess the severity of alcohol use disorder. The United States Preventive Task Force Services (USPTFS) recommends that clinicians use one of two brief screeners: Alcohol Use Disorders Identification Test (AUDIT-C) or Severity of Alcohol Dependence Questionnaire (SADQ). Both questionnaires are short and allow the nurse to quickly get information on the patient's drinking habits.

Importantly, these tools frame inquiries about the patient's alcohol use as open-ended questions rather than "yes" or "no." For example, in the AUDIT-C, a patient is asked to note the frequency of their alcoholic drink consumption within the last year (on a scale from "never" to "four or more times a week"), rather than asking the patient whether or not they have consumed alcohol within the past year ("yes" or "no"). The SADQ likewise asks patients to give a specific number—for example, asking, "How many times in the past year have you had (four for women, or five for men) or more drinks in a day?" rather than asking whether the patient has consumed four or five or more drinks in a day in the last year, to which they would respond with a closed-ended "yes" or "no."

The results of these shorter assessments can help the nurse identify any risky alcohol use behaviors that may need follow-up and additional screening. Even patients who score no or low risk still benefit from proactive, preventive steps to help reduce their risk for alcohol misuse in the future.

Alcohol Withdrawal

Symptoms of alcohol withdrawal range from mild to severe, depending on the severity of the AUD and length of time since the patient's last drink (Table 20.6). The symptoms can be organized into three categories: mild, moderate, and severe.

Time Frame	Withdrawal Symptoms
6 to 36 hours after last drink	Anxiety, minor agitation, restlessness, insomnia, tremor, diaphoresis, palpitations, headache, alcohol craving, loss of appetite, nausea, vomiting, diarrhea, sinus tachycardia, systolic hypertension, hyperactive reflexes
12 to 48 hours after last drink	Withdrawal hallucinations (visual, auditory, tactile)
6 to 48 hours after last drink	Alcohol withdrawal-related seizures
48 to 96 hours after last drink	Delirium tremens (DTs) with agitation, fever, severe tachycardia, hypertension, drenching sweats

TABLE 20.6 Withdrawal Timeline

Nurses in medical-surgical hospital settings or emergency departments commonly care for patients receiving withdrawal treatment for alcohol. Furthermore, patients frequently underreport alcohol use, so nurses must be aware of withdrawal signs in patients receiving medical care for other issues and notify the healthcare provider.

The prevalence of alcohol use disorder (AUD) is estimated to be high among hospitalized patients (Elliott, 2019). Approximately half of the patients with alcohol use disorder experience alcohol withdrawal when they reduce or stop drinking, with as many as 20 percent experiencing severe manifestations, such as hallucinations, seizures, and delirium tremens. Severe alcohol withdrawal is a medical emergency, best managed in an intensive care unit.

Without treatment, symptoms of mild alcohol withdrawal generally begin within six to thirty-six hours after the last drink and resolve within one to two days. Symptoms of early or mild alcohol withdrawal include anxiety, minor agitation, restlessness, insomnia, tremor, diaphoresis, palpitations, headache, and alcohol craving.

Patients often experience loss of appetite, nausea, vomiting, and diarrhea, and their fall risk often increases when they try to go unassisted to the bathroom with these gastrointestinal symptoms. Other signs at this stage of alcohol withdrawal include sinus tachycardia, systolic hypertension, and hyperactive reflexes.

Some patients develop moderate to severe withdrawal symptoms that can last up to six days, including withdrawal hallucinations, seizures, or delirium tremens.

- Hallucinations typically occur within twelve to forty-eight hours after the last drink. They are generally visual and commonly involve seeing insects or animals in the room, although auditory and tactile phenomena may also occur.
- Alcohol withdrawal-related seizures can occur six to forty-eight hours after the last drink. Risk factors for seizures include concurrent withdrawal from benzodiazepines or other sedative-hypnotic drugs.
- Delirium tremens, or DTs, is a rapid-onset, fluctuating disturbance of attention and cognition sometimes associated with hallucinations. In its most severe manifestation, DTs is accompanied by agitation and signs of extreme autonomic hyperactivity, including fever, severe tachycardia, hypertension, and drenching sweats. DTs typically begin between forty-eight and ninety-six hours after the patient's last drink. Mortality rates from withdrawal delirium have been historically as high as 20 percent, but with appropriate medical management, the mortality rate is between 1 and 4 percent. Death is attributed to cardiovascular complications, hyperthermia, aspiration, and severe fluid and electrolyte disorders.

Benzodiazepines may be prescribed to treat the psychomotor agitation that most patients experience during alcohol withdrawal as well as prevent progression of the minor symptoms to more severe symptoms of seizures, hallucinations, or Delirium tremens. Diazepam (Valium), lorazepam (Ativan), and chlordiazepoxide (Librium) are

used most frequently to treat or prevent alcohol withdrawal symptoms.

Special Developmental Considerations

A patient's developmental age and stage of life affect the nursing assessment for use of alcohol. The nurse first needs to establish whether a patient has the capacity to understand alcohol use and its consequences. For example, a young teenaged patient may not be able to fully grasp the risks of their alcohol use, either in the short or long term, due to the limitations of their still-developing brain. The nurse needs to consider the context of the patient's development when both assessing and discussing alcohol use.

There are also special developmental stage considerations that are not related to comprehension, but rather, to life events at that stage that may be important for the nurse to note. For example, women of reproductive age who could become or are currently pregnant need to be counseled about the risks of alcohol use as it pertains to conception, pregnancy, and breastfeeding. Another common clinical situation would be an older adult patient who is taking multiple medications to manage chronic health conditions who may not be aware of the potential for these drugs to interact with alcohol.

Adolescents

Alcohol is the most commonly used substance among young people in the United States. Data from several national surveys document frequent use of alcohol among young people. The 2021 Youth Risk Behavior Survey (YRBS) found the following statistics among high school students over thirty days:

- 22.7 percent drank alcohol
- 10.5 percent binge drank
- 4.6 percent of drivers drove after drinking alcohol
- 14.1 percent rode with a driver who had been drinking alcohol

Adolescents who binge drink are at an increased risk for school, social, legal, and physical problems. They are also at an increased risk of alcohol poisoning, alcohol-related motor vehicle crashes, burns, falls, and drowning. The brain development changes noted in teens who binge drink may have lifelong effects.

Children and adolescents use alcohol and other substances for many reasons, including as a maladaptive coping strategy. While many of these reasons for alcohol use would also apply to adults, the nurse also needs to be aware of the following unique factors that may influence alcohol use in young people more so than in older populations:

- peer pressure and influence of social media
- school stress, academic performance, competitiveness in sports, and hobbies
- difficulty coping with hormonal, physical, and emotional changes of adolescence
- curiosity and drive to establish independence and/or test boundaries
- lack of healthy, effective, coping skills

Older Adults

AUD appears different in the older adult, as AUD could have been a lifelong activity or a newly developed coping mechanism. The Short Michigan Alcoholism Screening Test—Geriatric Version (SMAST-G) is used to evaluate alcohol use in older adults. The short evaluation allows the practitioner to assess alcohol consumption in a way that is specific to older adults, as it may be affected by variables like changes in metabolism associated with aging, liver function, and interactions with medications.

The following questions are asked during the evaluation:

1. Do you ever underestimate how much you drink when talking with others?
2. After a few drinks, have you sometimes not eaten or been able to skip a meal because you didn't feel hungry?
3. Does having a few drinks help decrease your shakiness or tremors?
4. Does alcohol sometimes make it hard for you to remember parts of the day or night?
5. Do you usually take a drink to calm your nerves?
6. Do you drink to take your mind off your problems?
7. Have you ever increased your drinking after experiencing a loss in your life?
8. Has a doctor or nurse ever said they were worried about your drinking?
9. Have you ever made rules to manage your drinking?

10. When you feel lonely, does having a drink help you?

The Patient Who Is Pregnant

The nurse needs to assess alcohol use in patients who are pregnant both for the health of the patient and the fetus. While the nurse can use adult alcohol use screening tools, they should consider the context of the patient's life stage. For example, pregnancy may introduce new stressors and physical/mental health changes that may influence a patient's health behaviors.

The patient needs to be educated on the risks of using alcohol while pregnant, not just for themselves but for their baby as well. A fetus is exposed to alcohol before birth when alcohol in the patient's bloodstream passes to the fetus via the umbilical cord. It is unsafe for patients who are pregnant to drink any amount of alcohol at any time during pregnancy. All types of alcohol are considered dangerous to an unborn baby, including wine and beer. Fetal alcohol spectrum disorder is preventable if patients who are pregnant or suspect they may be pregnant refrain from alcohol use. People with fetal alcohol spectrum disorder may display any of the following signs (CDC, 2023) (Figure 20.3):

- low birth weight
- poor coordination
- hyperactive behavior
- difficulty paying attention
- poor memory
- difficulty in school, especially math
- learning disabilities
- speech and language delays
- intellectual disability or low IQ
- poor reasoning and judgment
- sleep and sucking problems as a baby
- vision or hearing problems
- problems with heart, kidneys, bones
- shorter than average height
- small head size
- abnormal facial features

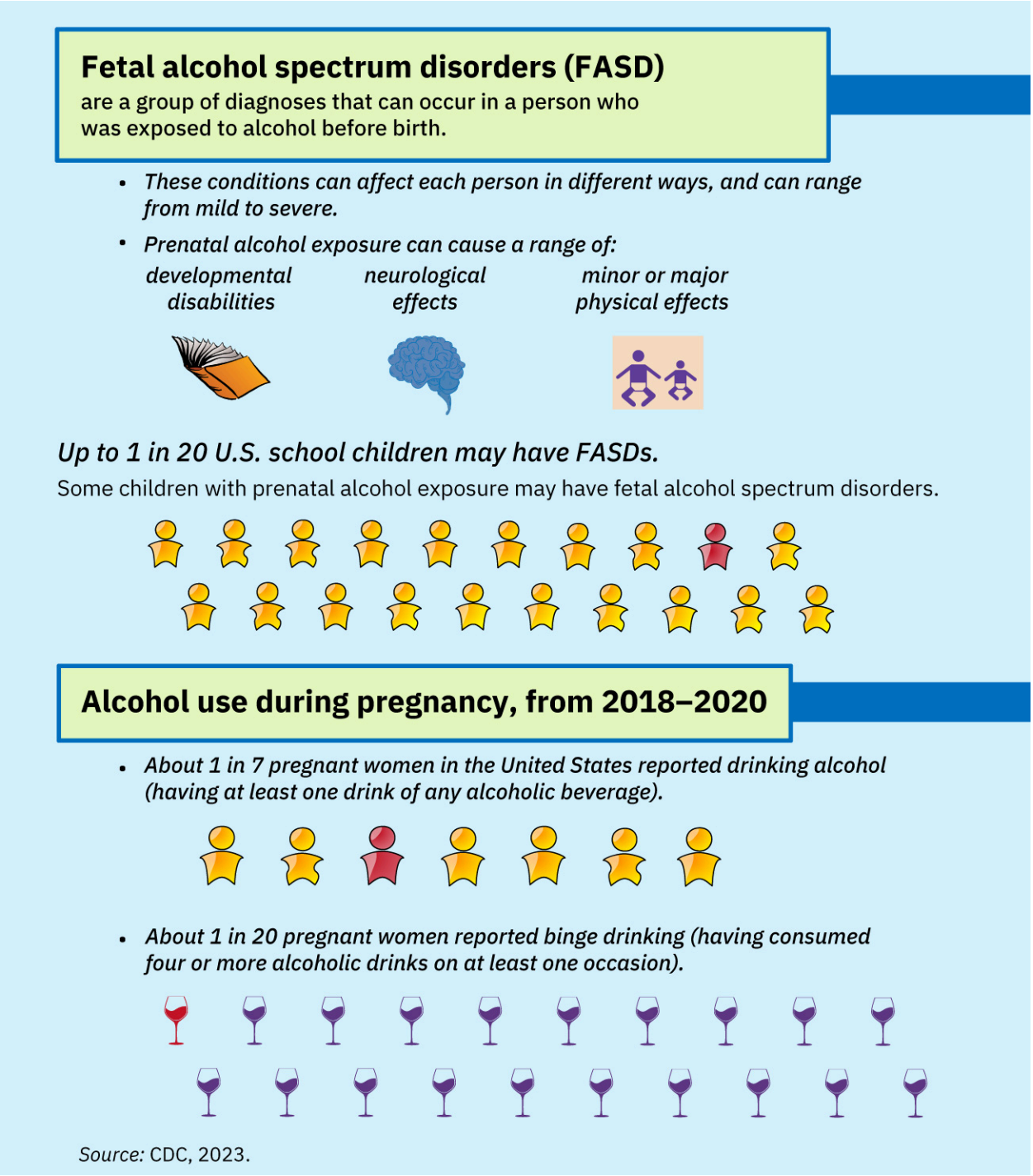

FIGURE 20.3 Fetal alcohol spectrum disorder is a range of effects that can occur in people with prenatal alcohol exposure. (credit: modification of work "Alcohol Use During Pregnancy" by Centers for Disease Control and Prevention, Public Domain)

It is important for nurses to be nonjudgmental but, at the same time, not downplay the urgency of not drinking while pregnant. By being honest with patients, nurses can earn their trust and have a greater chance of the patients being more transparent about their drinking. Nurses also have an opportunity to educate patients when they discover any patient misconceptions about alcohol use and abuse and the effects of alcohol on an unborn baby.

PATIENT CONVERSATIONS

Pregnant Patient with a History of Alcohol Use Disorder

Scenario: Esme is a nurse on a busy OB unit. She is caring for Jill, a patient who is twenty-one weeks pregnant with her second child. Her first child, now age two, is living with family members because he was born with fetal alcohol spectrum disorder and had to spend three months in the NICU after birth. Jill was admitted today, and Esme is performing her assessment.

Nurse: Hi, Jill. Now that we have performed the physical assessment, I will go through some questions about you and your life so we can provide you with the best care, okay?

Patient: Hi. I don't even know why I am here. My doctor's appointment seemed okay today, but the doctor has been worried about my baby's small size and told me I had to come in for some tests. My first baby was tiny too. My babies are just smaller, that's all.

Nurse: I understand. Let's see if we can find the answers together.

[During the alcohol and substance abuse portion of the assessment]

Patient: I do drink some alcohol, but only wine and beer. I drank the hard stuff before, but now that I know I'm pregnant, I cut down to the weak stuff so that I won't hurt the baby.

Nurse: Okay, I understand. How many beers or glasses of wine do you drink daily?

Patient: I always have a beer in the morning, then another at lunchtime. In the afternoon, I get together with my friends, and we finish a bottle of wine. I may have two or three glasses. Then in the evening, after dinner, I like to sit on the porch with my boyfriend and share a six-pack. He usually drinks three to four, and I drink the rest. So, I guess that's seven or eight drinks a day, but it's okay because I never get drunk, and I still know where I am and who I am, so it won't hurt the baby.

Nurse: Thanks for sharing that information with me. Jill, I want to be honest with you so I'm sure you have the correct information. Any alcohol at any time while pregnant can affect your baby. It doesn't matter if you feel drunk or not, and it doesn't matter if you're drinking wine, beer, or vodka. Any amount of alcohol can affect your baby.

Patient: Oh wow. I guess I didn't realize that. I have another son who was taken away from me because he had to go to the NICU after birth. He had a tiny body and a very small head. They tried to say that it was my fault.

Nurse: Well, I'm so sorry you didn't get to spend time with your baby after his birth. Let's discuss how to improve your health and keep this baby healthy.

Patient: Okay, that sounds good. I'll do anything to keep this baby safe.

Nurse: There's something called fetal alcohol spectrum disorder that affects babies born to mothers who have used alcohol during pregnancy. Some of the symptoms are low body weight, attention deficits, poor memory, learning disabilities, vision and hearing problems, and potential issues with their hearts, kidneys and bones, to name a few.

Patient: I didn't realize it was that bad. I just thought it might make the baby relaxed or something.

Nurse: You have done a great job of transparently sharing your drinking with me, and I'm so thankful for that. If you feel ready to talk about ways to improve your life and give your baby the best start possible, we have a treatment team who can make that happen, but it takes your total commitment. Do you think you're ready?

Patient: I'm ready. I have to change for both of my kids.

Assessment Considerations for Substance Abuse Disorder

The *Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR)* gives the provider a systematic way to accurately assess patients for SUD. A diagnosis of SUD can be categorized as mild, moderate, or severe. Mild SUD is characterized by the existence of two or three of the following criteria; moderate SUD is characterized by four or five; and severe SUD is characterized by six or more (American Psychiatric Association, 2022):

- substance commonly taken in larger amounts or for a longer time than the patient intended
- persistent desire or one or more unsuccessful efforts to cut down or control substance use
- excessive time devoted to activities necessary to obtain the substance
- cravings and urges to use the substance
- impaired occupational, social, or recreational activities
- continued substance use despite the recognition of a persistent or recurrent psychological, social, or physical problem that's caused or exacerbated by the use of the substance
- avoidance or giving up of occupational, social, or recreational activities due to the substance use
- continued use of the substance despite the dangers of doing so
- continued use despite awareness of a psychological or physical problem possibly from or worsened by the substance
- marked tolerance (evidenced by a need for significantly increasing the amount of the substance to achieve intoxication or the desired effect or a significantly diminished effect with use of the same amount of the substance)
- characteristic withdrawal symptoms relieved by taking more of the substance

Many times, people who use substances develop tolerance. Tolerance is when someone needs more and more amounts of the substance to feel the same level of intoxication or feeling they previously had. This means that when they take the same dose, the physical effect is less, thus necessitating the need for a higher consumption. Additionally, the patient begins to develop withdrawal symptoms whenever they cut back or stop using the substance.

Special Developmental Considerations

As with alcohol use, the nurse also needs to consider the developmental stage of the patient when assessing other substance use. While many risk factors and consequences of drug use are shared by patients across the life span, there are also some specific risks that are unique to patients based on their age.

School-Aged Children

School-aged children are at risk of being exposed to illicit drugs by caregivers and other adults in their lives, as well as older children (including schoolmates, friends, and siblings). A child may also learn about drugs from online content, social media, and television.

However, a child's understanding of drugs and their risks is often limited because of their developmental stage. They may not have much "real world" context for what they hear or see about drugs and may have many questions and misunderstandings. The nurse needs to be aware of the child's possible confusion and consider this carefully during the assessment. It's also important that the child understands that they can be open and honest with the nurse, and that it is a safe space to talk about drugs (which the child may broadly understand as being a "bad" topic).

The drug use screeners that the nurse has available may be adaptable to a pediatric patient, such as the Alcohol, Smoking and Substance Involvement Screening Tool (ASSIST). Tools such as the Car, Relax, Alone, Family, Friends, Trouble (CRAFFT) Questionnaire are validated for children ages 12 and up. The nurse also needs to emphasize to a child patient's caregivers the importance of discussing drug use proactively. Prevention starts at home with having open, honest conversations about the risks of drug use and setting clear expectations—that is, making sure a child knows that drug use will not be tolerated.

LINK TO LEARNING

SAMHSA, the Substance Abuse and Mental Health Services Administration (SAMHSA) provides a free mobile app (https://openstax.org/r/77SAMHSAMobApp) to help parents initiate a conversation with children. The app is called "Talk. They Hear You," and it is available in the Google Play store, the App Store, and from Microsoft (SAMHSA, 2015).

Adolescents

When assessing SUD in adolescents, it is important for the nurse to understand what the patient considers to be drugs or abuse. For example, adolescents may not realize that painkillers can be just as harmful as illicit drugs.

During the assessment, the nurse should ask the patient about their use of pain medicines, including prescription pain relievers. They should also ask the patient if they take and use medicines not prescribed to them or obtain medicines from sources other than their healthcare provider.

Adolescents need to be specifically asked if they are hiding drug-related behavior from their parents or caregivers. The nurse must assess the patient for physical signs of SUD, such as slurred speech, drowsiness, shallow breathing, disorientation, and lack of coordination.

According to the 2023 results of the Monitoring the Future survey conducted by the National Institute on Drug Abuse at the National Institutes of Health, teens are using prescription drugs without a doctor's orders less than in the past. In 2023, about 9 percent of twelfth graders reported ever using a prescription drug without a doctor's order. Even so, prescription drugs are still a risk for adolescents. Compared to other illicit substances, prescriptions can be more readily available to teens—for example, because someone in their home has been prescribed medications.

When assessing adolescent patients for SUD, the nurse needs to ascertain the teen's awareness of drugs, their understanding of the risks, and their access to substances. Much of this information can be gleaned from screening tools, but the nurse must also be sensitive to the needs of a teenaged patient who may be hesitant to be open and honest.

Young people may get inaccurate information about drugs from their peers, the internet, and the media they consume. They may be curious or confused about drugs but not want to ask questions for fear of judgment, ridicule, or punished. While the nurse is assessing the patient, they should be cognizant of the fact that an adolescent may have misinformation about drugs and the risks associated with them.

Many people, not just teenagers, also hold the misperception that prescription drugs are somehow less harmful to their bodies than other drugs. This is, unfortunately, untrue. In doing the assessment, the nurse has an opportunity to identify gaps in a teen's knowledge as well as address any misconceptions or misinformation about drugs. The nurse can explain that each drug class has short- and long-term health consequences when misused:

- Stimulants have many side effects in common with cocaine, including paranoia, dangerously high body temperature, and heart rate irregularities, especially if used in combination with other drugs.
- Opioids act on the same part of the brain as heroin and can cause drowsiness, nausea, constipation, and slowed breathing (depressed respiratory drive) if a large amount is taken.
- Depressants can cause slurred speech, shallow breathing, fatigue, disorientation, lack of coordination, and seizures upon withdrawal from chronic use (Substance Abuse and Mental Health Services Administration, 2022).

Older Adults

According to recent studies, illicit drug use declines after young adulthood. However, about 4 percent of adults aged 65 and older in the United States abuse substances (Jaqua et al., 2022). The nurse must consider the possibility of substance use in older adults as well as understand the specific age-related factors that can affect the assessment.

Older adults may have physical and/or cognitive changes that may require the nurse to rethink their approach to asking about substance use. For example, a patient who is partially deaf may not be able to discuss their substance use easily. The nurse may want to write down questions or use visual aids to help get an accurate assessment. Patients who have cognitive impairment or memory disorders may not be able to reliably recall their substance use or may become confused during the course of the assessment.

Taking multiple medications, also known as **polypharmacy**, is another concern for older adults. Older adults may metabolize drugs more slowly and can therefore be more sensitive to them. Patients who have multiple chronic health conditions to manage are more likely to be taking multiple medications. As more medications are added, the risk of drug interactions increases, putting them at even greater risk of side effects and adverse outcomes. Many older adults use prescribed opioid pain medications and take them long-term for chronic conditions.

Older adults, like patients in other age groups, can also experience life stressors and changes that may drive substance use. For example, the older adult may turn to substances to cope with depression, poor health, injuries, social isolation, a loss of independence, the deaths of spouses and friends, as well as worries about their own

mortality.

The Patient Who Is Pregnant

Caring for a patient who is pregnant and experiencing drug addiction is complex, because two patients require care, and their future health depends upon the patient's choices (Table 20.7). When a patient who is pregnant exposes their unborn child to illicit drugs in utero, the fetus is at a higher risk of certain short-term and long-term complications. The baby is more likely to experience congenital disabilities and/or withdrawal symptoms after birth. The baby has a higher risk of losing their life to sudden infant death syndrome (SIDS) and, as they age, their risks of poor growth rates and cognitive and behavioral problems also increase. Likewise, the patient is at an increased risk of miscarriage, preterm labor, or stillbirth.

Drug	Effects on Baby during Pregnancy
Opioids	Miscarriage, low birth weight, neonatal abstinence syndrome
Cocaine	Premature delivery, low birth weight, deficits in self-regulation and attention in school-aged children prenatally exposed
Methamphetamine	Premature delivery, separation of the placenta from the uterus, low birth weight, lethargy, heart and brain problems
Nicotine/vaping	Miscarriage, low birth weight, stillbirth, learning and behavior problems
Benzodiazepines	Higher rate of Cesarean section, baby three times more likely to require ventilation after birth
Marijuana	Babies born with problems with attention, memory, and problem-solving

TABLE 20.7 Drug Effects on Babies Exposed to Drugs during Pregnancy (Source: Ross et al., 2015.)

Types of Illicit Drug Use

There is a range of illicit substances on which the nurse needs to be educated, some of which they may be more familiar with than others. Alcohol, cannabis, and tobacco are among the most commonly used substances that the nurse will discuss with patients (Table 20.8). As a healthcare professional, the nurse may be familiar with over-the-counter and prescription medications, including painkillers, opiates, and benzodiazepines. Some illicit drugs are more well-known as "street drugs," such as heroin, cocaine, and methamphetamine. Hallucinogens and synthetic drugs are also substances of which the nurse should be aware.

Drug	Common Forms	Common Ways Taken
Alcohol	Liquid	Various alcoholic drinks, including wine, beer, and spirits
Cannabis	Greenish-gray mixture of dried, shredded leaves, stems, seeds, and/or flowers; resin (hashish); or sticky, black liquid (hash oil)	Smoked, vaped, eaten (mixed in food or brewed as tea)
Benzodiazepines	Pill, capsule, liquid	Swallowed, injected, snorted
Cocaine	White powder, whitish rock crystal	Snorted, smoked, injected

TABLE 20.8 Commonly Used Drugs (Source: National Institute on Drug Abuse, 2020a.)

Drug	Common Forms	Common Ways Taken
Heroin	White or brownish powder, or black sticky substance known as "black tar heroin"	Injected, smoked, snorted
LSD	Tablet; capsule; clear liquid; small, decorated squares of absorbent paper to which liquid has been added	Swallowed, absorbed through mouth tissues (paper squares)
MDMA (ecstasy)	Colorful tablets with imprinted logos, capsules, powder, liquid	Swallowed, snorted
Methamphetamine (meth)	White powder or pill; crystal meth looks like pieces of glass or shiny blue-white "rocks" of different sizes	Swallowed, snorted, smoked, injected
PCP (angel dust)	White or colored powder, tablet, or capsule; clear liquid	Injected, snorted, swallowed, smoked (powder added to mint, parsley, oregano, or marijuana)
Prescription opioids	Capsule; liquid; tablet; in some cases, suppository, sublingual tablets, film, buccal tablet	Injected, smoked, snorted, rectally if suppository
Psilocybin (mushrooms)	Fresh or dried mushrooms with long, slender stems topped by caps with dark gills	Swallowed (eaten, brewed as tea, or added to other foods)
Rohypnol (roofies)	Pill	Swallowed, dissolved in a drink
Synthetic cannabinoids	Dried, shredded plant material that looks like potpourri and is sometimes sold as "incense"	Smoked, swallowed (brewed as tea)
Synthetic cathinones (bath salts)	White or brown crystalline powder sold in small plastic or foil packages labeled "not for human consumption" and sometimes sold as jewelry cleaner; tablet; capsule; liquid	Swallowed, snorted, injected
Tobacco/nicotine/vaping	Cigarettes; vaping devices such as e-cigarettes; cigars; bidis; hookahs; kreteks; smokeless tobacco such as snuff, spit tobacco, chew	Smoked, snorted, chewed, vaporized

TABLE 20.8 Commonly Used Drugs (Source: National Institute on Drug Abuse, 2020a.)

The nurse needs to be aware of not only the types of drugs patients may misuse but also the signs of abuse that can be specific to certain drugs. While there are some general patterns of behavior as well as physical and mental health symptoms that may broadly apply to substance use, each drug may also have its own "telltale" signs. The patient's physical and emotional presentation during the assessment can provide the nurse with additional data, which will need to be considered in the context of the patient's scores on screeners for drug use.

The tools used for substance use screening can help the nurse ascertain the patient's level of awareness and understanding of specific drugs. If the patient is using substances, further questioning can help the nurse determine the patient's level of insight into their drug use. For example, a patient may or may not think their substance use is a problem and may not be aware of (or in denial of) the risks and consequences associated with SUD.

Drug use can also contribute to health risks by altering a person's judgment and rational thought. This includes the potential for addiction, driving under the influence, increased chances of catching an infectious disease, and adverse effects on pregnancy.

Illicit Drug Withdrawal

The nurse needs to use their clinical judgment, experience, and available tools to assess whether a patient who reports using substances is addicted to drugs. It's important for the nurse to recall the differences between drug dependence and addiction and be equipped to recognize the behaviors that can separate these two patterns of substance use.

The nurse also needs to evaluate the patient for drug withdrawal (Table 20.9). While the patient may report symptoms of withdrawal, the nurse also needs to observe the patient for the signs and symptoms of drug withdrawal during the assessment.

Substance	Withdrawal Symptoms
Alcohol	Restlessness, sweating, tachycardia, vomiting, irritability, seizures, headache, disorientation
Cannabis	Irritability, trouble sleeping, decreased appetite, anxiety
Benzodiazepines	Must be discussed with a healthcare provider; barbiturate withdrawal can cause severe abstinence syndrome that may even include seizures.
Cocaine	Depression, fatigue, increased appetite, insomnia, vivid and unpleasant dreams, slowed thinking and movement, restlessness
Heroin	Restlessness, muscle and bone pain, insomnia, diarrhea, vomiting, cold flashes with goose bumps
LSD	It is unknown if LSD withdrawal includes any symptoms.
MDMA (ecstasy)	Fatigue, loss of appetite, depression, trouble concentrating
Methamphetamine (meth)	Depression, anxiety, fatigue
Opioids (heroin, fentanyl, morphine, codeine, Vicodin, Norco, oxycodone)	Restlessness, muscle and bone pain, insomnia, diarrhea, vomiting, cold flashes with goose bumps, and leg movements
PCP (angel dust)	Headaches, increased appetite, sleepiness, depression
Psilocybin mushrooms)	It is unknown if psilocybin withdrawal includes any symptoms.
Rohypnol (roofies)	Headache; muscle pain; extreme anxiety, tension, restlessness, confusion, irritability; numbness and tingling of hands or feet; hallucinations, delirium, convulsions, seizures, or shock
Synthetic cannabinoids	Headaches, anxiety, depression, irritability
Synthetic cathinones (bath salts)	Depression, anxiety
Tobacco/nicotine/vaping	Irritability, attention and sleep problems, depression, increased appetite

TABLE 20.9 Substances and Their Associated Withdrawal Symptoms (Source: National Institute on Drug Abuse, 2020a.)

The Nurse's Role in Managing Substance Misuse

The nursing process functions as a systematic approach to patient-centered care. The five steps of the nursing process include assessment, diagnosis, planning, implementation, and evaluation. This section applies the nursing process to care for a hospitalized patient with a substance use disorder (SUD) who receives withdrawal treatment.

Nursing Assessment

When assessing a patient for drug and alcohol misuse, the nurse should begin with a thorough history. The nurse should establish if the patient has any history of substance abuse, a history of withdrawal symptoms they have experienced in previous attempts to quit using, their treatment history, their mental health and social history, and any medical history of new physical symptoms they are experiencing.

In addition to the history, the patient's lab values can provide much information about their current state of health. When evaluating a patient for substance or alcohol use disorder (AUD), there are certain labs that should be assessed (Table 20.10).

Lab	Assessment
Complete blood count (CBC)	Anemia, infections
Glucose	Hyper/hypoglycemia
Serum electrolytes	Potassium, magnesium, and phosphate abnormalities, particularly with severe dehydration
Creatinine	Kidney function
Liver function	Liver damage
Amylase and lipase	Pancreatitis
Urine drug testing	Current/recent use of specific substances, including benzodiazepines, cocaine, opioids
Blood alcohol levels	Intoxication levels, abuse
Urine hCG	Pregnancy (in patients of reproductive age)
ECG	Cardiac function, complications (indicated for patients over age 50)

TABLE 20.10 Lab Assessments for SUD

Nursing Diagnosis

A nursing diagnosis is made by gathering and analyzing patient data, then using that data to construct a path forward for managing the patient's current or potential symptoms. Through assessment, the nurse elicits subjective details from the patient about their substance use and observes objective information to create a full picture of the patient's present state. In analysis, the nurse identifies risk and protective factors, behaviors, and other influences on the patient's substance use.

There are a few common clinical scenarios the nurse may encounter when formulating a nursing diagnosis for a patient who is abusing substances. One example would be impaired coping, which is both a factor that contributes to the development of and a barrier to overcoming substance use. By identifying the patient's need for more effective coping skills in the nursing diagnosis, the nurse starts putting together an action plan with interventions that will support the patient in developing healthy coping skills, reducing their reliance on substances, and preventing relapse. For example, the nurse may discuss coping skills and stress-management techniques with the patient, encourage them to take part in community resources such as support groups, and connect them with other healthcare providers such as therapists.

Outcome Identification

The nurse then considers the intended end result for the patient, or their future goal. An appropriately written goal is specific, measurable, attainable, realistic, and has a time/deadline (SMART). An example of a broad goal related to withdrawal would be that the patient will stabilize and remain free from injury. There are also some additional goals that the nurse may consider for the patient:

- The patient's vital signs will remain within normal ranges during treatment. The nurse regularly assesses the patient's vitals to determine the response to treatment and quickly identify any signs of possible

complications, such as hemodynamic instability.
- The patient's electrolyte levels will remain within normal ranges during treatment. As there can be electrolyte disturbances from various factors during withdrawal, such as dehydration, the nurse needs to monitor the patient carefully for signs of electrolyte abnormalities.
- The patient will participate in planning a post-withdrawal treatment program before discharge. By actively engaging the patient in developing a post-hospital plan, the nurse is able to continue to assess the patient's insight into substance use and their ability and willingness to comply with treatment. Involving the patient also gives them some agency in the decision-making process, which can help motivate them to meet their long-term goals (e.g., maintaining sobriety).

Nursing Interventions

When planning interventions for SUD, the nurse needs to approach it from a patient-centered view. Each patient will need an individualized plan, and there will be specific factors, barriers, and goals for each patient. Key considerations during the planning stage are the severity of the patient's substance use, any other medical or mental health conditions they have, their level of support (social, financial), and how ready and able they are to commit to change.

The approach that the nurse takes to planning, as well as the interventions they select, will depend on these patient factors, as well as available resources. For example, a patient who demonstrates willingness to try to make changes but is hesitant may benefit from a more phased approach that "meets them where they are" in their current stage and gradually guides them to their long-term goal. The order in which the nurse plans interventions will, to some degree, be dictated by the acuity of the patient's condition. In some circumstances, such as managing a patient who has more urgent needs related to drug overdose or self-harm, the nurse needs a more immediate action plan to ensure the patient's safety.

The nurse needs to take an interdisciplinary and collaborative approach to planning that involves the patient's support system, other healthcare providers, and community resources. This could include referrals for psychotherapy, connecting with local support groups, and following up with their primary care physician.

The specific interventions that the nurse includes will also depend on how feasible they are for a particular patient. For example, even if a patient is willing, there might be practical (such as transportation) or financial (such as healthcare) barriers to participating in community-based therapy that the nurse will need to consider. Another patient may have multiple medical conditions that need to be managed at the same time as they are working toward their goal of sobriety. Some patients may not have support from their family and friends, which presents challenges to their long-term goal of abstaining from substances. If a patient has loved ones who are still using substances, this can present a risk factor for relapse that the nurse needs to proactively plan to prevent.

CLINICAL JUDGMENT MEASUREMENT MODEL

Analyze Cues: Determining Patient Needs

A 42-year-old male patient with a history of excesssive alcohol use is brought to the unit after being found unresponsive at home by his neighbor. The nurse's first task is to determine the patient's immediate needs by assessing vital signs, checking labs, and reviewing the EHR for medical and social history.

Based on the patient's presentation (tachycardia, tremors), history (chronic alcohol use with previous attempts to stop drinking), and lab results (elevated blood alcohol level on admission), the nurse understands that the patient is in symptomatic alcohol withdrawal.

The nurse formulates the next steps in providing care based on the patient's immediate needs for safety and symptom management.

Nursing interventions provide a supportive environment while the patient undergoes withdrawal treatment. Vital signs are monitored closely because increases in temperature, pulse, and blood pressure are signs of withdrawal. After ensuring that an individual's physiological needs of airway, breathing, and circulation are met, safety measures receive top priority. Safety measures during withdrawal treatment may include interventions such as fall precautions, seizure precautions, or implementing restraints as needed to maintain the safety of the individual or

those around them.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Applying an Extremity Restraint

See the competency checklist for Applying an Extremity Restraint. You can find the checklists on the Student resources tab of your book page on openstax.org.

Evaluation

Evaluation involves assessing the individualized outcomes related to the effectiveness of symptom management and the withdrawal treatment plan. In the evaluation stage, the nurse looks at the patient's goal and uses the details and timeline to assess whether the goal has been met. The nurse needs to ask questions such as, "Did the patient do the activity or meet the specific guidelines? Were they able to do them within the timeline?"

For example, if the goal was for the patient to have vital signs within normal limits while in the hospital, the nurse investigates whether the patient's vital signs every day that they were in the hospital had been within normal range. If the measurements were all normal, then the goal was met. If the measurements were abnormal, then the goal was not met. If the goal was met, no further action is needed. If the goal was not met, the nurse must revise the interventions and make a new goal for the patient.

Patient Education

Patient education is a vital step in the nursing process that involves providing patients with the information they need to make informed decisions about their health. The goal of patient education is to assist patients in understanding their medical conditions, treatment options, and important self-care measures they can employ to promote better health outcomes. Throughout this process, patients are empowered to take an active role in managing their health (Paterick et al., 2017).

20.3 Abuse and Neglect Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Recognize different types of abuse to make informed clinical decisions regarding patient care
- Discuss the negative implications of violence and abuse related to health and wellness
- Identify nursing considerations for patients involved in abuse or violence

Nurses provide care for patients who are experiencing or have experienced neglect, abuse, and intimate partner violence. In some settings, nurses may even experience workplace violence themselves while caring for agitated or combative patients. Nurses should learn to thoroughly and sensitively assess all patients for physical, sexual, and emotional abuse and exposure to abuse. But first nurses must learn what constitutes abuse, the types they may encounter, and the various responses they will see when working with patients of different ages, cultures, and backgrounds. The content in this chapter may trigger powerful emotions, especially for people who have experienced similar traumatic experiences. Self-awareness and self-care practices should guide your engagement with this chapter.

Types of Violence and Abuse

Violence and abuse are unfortunate realities affecting every part of our society, from the home to the school and the workplace. With the prevalence of violence in the United States today, understanding the various types of abuse and violence will assist with prevention. Assessing patients for violence and abuse involves knowing how to recognize the signs and effects. The nurse also needs to understand their role and duty to respond and ensure the patient's safety, as well as take proactive steps to prevent abuse. The term **interpersonal violence** refers to the intentional use of force against another person; the **abuse** can be physical, sexual, or emotional. Abuse can take many forms, including physical, emotional, psychological, verbal, sexual, and financial. Failure to care for properly, also known as **neglect**, is also a form of abuse. Harassing behavior, or **bullying**, can take place in person (such as at school or in the workplace) or online (cyberbullying). This section explores the multiple forms of abuse and its effects on people and communities.

Intimate Partner Violence

Intimate partner violence, sexual assault, and rape have long-lasting effects on the people who experience them. Violence or abuse by a current or former spouse or dating partner is known as **intimate partner violence**. These crimes happen to both males and females and are often associated with substance use. A recent national survey found that 22 percent of women and 14 percent of men reported experiencing severe physical violence from an intimate partner in their lifetimes (U.S. Department of Health and Human Services, 2016). Intimate partner violence is a significant public health issue with many individual and societal costs. About 35 percent of females and more than 11 percent of males who have experienced intimate partner violence experience some form of physical injury related to the violence, and some deaths occur. About one in five homicide victims are killed by an intimate partner, and more than half of female homicide victims in the United States are killed by a current or former male intimate partner. Such abuse can cause ongoing psychological trauma for the person experiencing it (Mehr et al., 2023). A **psychological trauma** refers to a person's emotional response to a distressing experience.

When assessing for intimate partner violence, the nurse asks the patient questions about exposure to abuse. However, a patient may not always feel they can be forthcoming and honest about abuse they may be experiencing. Shame, fear, and uncertainty can all affect a patient's responses to the nurse's screening questions about violence and abuse. Therefore, the nurse also observes the patient for possible signs, both physical (like bruises) and behavioral, that could indicate abuse.

Physical Abuse

The term **physical abuse** is described as the cruel and violent treatment of another person. Physical abuse is what many think of when hearing the word *abuse* or *violence*. Physical abuse can include hitting, slapping, kicking, punching, strangling, physically restraining a person against their will, reckless driving, invading someone's physical space without their consent, or in any other way forcing them to feel unsafe (REACH Beyond Domestic Violence, 2023).

Assessing and screening people who have experienced sexual violence can be complicated. The nurse must be mindful that the evidence of violence might be visible or invisible. The nurse should see if any **patterned injury** is found, which is a form of physical abuse that leaves a patterned mark on the person. This type of injury can be caused by a weapon's impact on the body or by contact with the body by a patterned surface. Random bruising, cuts and scrapes, welts, and other visible injuries can also occur. If the injuries are on easily seen parts of the body (face, arms), the nurse should be aware that the patient may attempt to conceal the injuries (makeup, long sleeves) or come up with an explanation ("I fell down the stairs") that does not necessarily fit the pattern or severity of the injury.

There can also be psychological and behavioral signs of abuse that the nurse needs to be able to spot, including anxiety, fearfulness, hypervigilance, depression, low self-esteem, or submission (e.g., not making eye contact). The patient may also have vague, nonspecific symptoms (such as headaches) that may not have a clear physical cause and could be a manifestation of the extreme stress they are enduring in their environment.

If the abuser has accompanied the patient to their appointment and is in the room, the nurse should be alert to how this will affect the assessment process. Even if the nurse asks the partner to leave the room, the patient still may not feel safe enough to be honest with the nurse when questioned. The nurse's observations and context from the patient's medical record (such as frequent ER visits for injuries sustained due to "clumsiness" or accidents) can help them create a more complete picture of the patient's risk for violence and abuse.

Sexual Violence

Forcing or manipulating someone into unwanted sexual activity without consent is known as **sexual violence**. Although sexual violence is a type of physical abuse, it also has psychological and emotional components. Sexual abuse can involve rape or other forced sexual acts, withholding sex, or using it as a weapon. Sexual relations have many emotional and cultural implications. Because of this, there are many ways it can be used for control and to gain power over another person. In the United States, marital rape was not illegal in all fifty states until 1993. This is significant because many people falsely assume that sexual relations are something they are entitled to (REACH Beyond Domestic Violence, 2023). People who have experienced sexual violence are prevalent in society. Nurses should be mindful of this in all patient interactions. For instance, one out of every six women has experienced attempted or completed rape (RAINN, 2024).

Assessing and screening people who have experienced sexual violence can be complicated. The nurse must be mindful that the evidence of violence might be visible or invisible. The nurse should assess for all components of sexual violence, from the physical to the emotional. Taking a careful history, being a keen observer of the patient's current state, and using screening tools to identify abuse and risk of abuse are key aspects of doing an assessment for sexual violence (Table 20.11).

Term	Definition
Authorization	An individual's signed permission to allow a named person or facility to use or disclose their protected health information (PHI). To comply with HIPAA, the nurse needs to obtain the patient's authorization as part of the required documentation for sexual assault.
Colposcope	A lighted instrument initially used to magnify the female cervix to identify disease as well as identify genital trauma, sexual assault, and abuse
Emergency contraception	Medications used in the first few days after unprotected intercourse to prevent pregnancy
Human trafficking	A modern-day form of slavery involving the illegal trade of people for exploitation or commercial gain
Incapacitation	A person's inability to make their own decisions about their care
Informed consent	A statement that adults of sound mind can make their own decisions about the health care they will receive
Intimate partner violence	Physical, sexual, or psychological harm caused by a current or former spouse or partner
Mandatory reporting laws	Requires healthcare providers to share information with law enforcement or other agencies that would otherwise be considered a HIPAA violation. Every U.S. state has laws requiring reporting suspected child abuse. Some states also require the reporting of elder abuse, the abuse of at-risk adults, specific types of inflicted injuries, and some infectious diseases.
Medical forensic examination	A physical examination of a patient who has experienced sexual assault performed by a healthcare provider with specialized training and experience in the collection of forensic evidence
Mental capacity	A person's ability to make their own decisions about the care they receive
Rape	Penetration, no matter how slight, of the vagina or anus with any body part or object, or oral penetration by a sex organ of another person without consent
Sexual violence	A sexual act committed against a person without their consent
Sex workers	Individuals whose work involves sexually explicit behavior

TABLE 20.11 Terminology in Sexual Assault Screening, Assessment, Treatment, and Documentation

Term	Definition
Trauma-informed care	Care that seeks to understand the connection between a patient's symptoms and their history of trauma
Victim advocate	Member of a multidisciplinary team whose responsibility is to provide support to the person who has experienced sexual assault.

TABLE 20.11 Terminology in Sexual Assault Screening, Assessment, Treatment, and Documentation

Psychological or Emotional Abuse

A verbal or nonverbal (nonphysical) behavior that controls, isolates, or inflicts anguish, mental pain, fear, or distress on a person is referred to as **emotional abuse**. Examples include humiliation or disrespect, verbal and nonverbal threats, harassment, constant monitoring, stalking, and geographic or interpersonal isolation (National Domestic Violence Hotline, 2021). Threats of violence are a form of emotional abuse, because they leave the person anxious, fearful, and dreading the day the abuser follows through on their threats.

When the nurse assesses for emotional abuse, it must be done with care because the patient is particularly vulnerable to the nurse's tone and nonverbal behavior. It is critical that the nurse establish rapport with the patient to create a safe, open, nonjudgmental environment. The patient may struggle to trust the nurse and may be hesitant to answer even basic questions as part of the assessment. The nurse may be able to encourage disclosure by asking open questions and actively, empathetically listening when the patient does respond. A patient experiencing abuse may constantly seek approval and be overly apologetic, so the nurse's demeanor should remain supportive and open.

Throughout the conversation, the nurse also needs to pay attention to the patient's nonverbal cues and communication. For example, is the patient anxious, fidgeting, keeping their eye on the doorway? Are they unkempt or showing signs of stress? Are they showing signs of substance use? Have they lost or gained weight since their last appointment? Do they look as though they are not sleeping well? Are there signs of lacking self-care (e.g., body odor, unwashed hair)? The nurse can also question the patient about these factors directly—for example, asking about sleep, diet, and stressors.

If the patient does disclose potential abuse to the nurse, they may blame themselves and justify their partner's behavior. Even if the nurse provides reassurance that the abuse is not the patient's fault, they may not be receptive to it. In fact, the patient may attempt to "backpedal" or "take back" what they said if they fear there will be repercussions from the abuser, or if they have doubt because the abuser has consistently made them question whether the abuse is real.

Coercion/Coercive Tactics

A form of psychological and emotional abuse where control, manipulation, and oppression are strategically used by the abuser to maintain power and influence over someone else is called **coercive control**. To assess for coercion, the nurse must pay attention to the patient's behavior with their partner compared to when they are alone. It is best if the nurse can assess the patient without their partner present. If the partner is present, the nurse must consider their behavior as well. For example, are they touching the patient in any way? Physical touch can be used to direct the patient to answer questions in a certain way. Does the patient look to their partner for direction at every question asked? They may be seeking approval or permission.

Risk factors include being a female between the ages of 18 to 29 with low income, low education, emotional or financial dependency, low self-esteem, and/or a history of being physically abused. Coercive control is ongoing and often entails manipulative strategies where the person is denied autonomy and a sense of self. Coercion is especially dangerous because the person may not realize they are being manipulated and controlled until their self-esteem and senses of autonomy and safety have unraveled completely (Psychology Today, 2022).

Financial Abuse

The illegal, unauthorized, or improper use of money, benefits, belongings, property, or assets for the benefit of someone other than the property owner is known as **financial abuse**. People of advanced age, people with disabilities, and other at-risk populations are at higher risk of financial abuse. People experiencing financial abuse

often cannot acquire, spend, or maintain their own financial resources. Financial abuse can also be a coercive means of keeping someone in a relationship. People are often too afraid to leave because they cannot financially support themselves. Financial abuse is a form of **exploitation**, which means mistreating someone to benefit from their work or resources.

To assess the patient for financial abuse, the nurse can start with open-ended questions such as, "Do you have any concerns about managing your money?" or "Do you have stress related to paying bills or earning income?" that help establish the patient's thoughts about their personal finances. Then, the nurse should get more detail about how involved the patient is with their finances, such as "Do you feel in control of how your money is used?" or "Do you know how your money is used?"

As the nurse is gathering information, they should observe the patient's demeanor and responses throughout the conversation. Do they appear anxious and confused when discussing their financial situation? Do any of their answers fail to "add up" when considering the patient's employment and lifestyle? Do they seem to be unaware of key aspects of their financial well-being, such as how much debt they have or whether they have a savings account?

Patients who struggle to understand their money due to financial illiteracy and are dependent on a partner to "handle the money" in the relationship are not necessarily experiencing financial abuse. However, the assessment process helps the nurse differentiate between a reliance or arrangement that is beneficial from one that is exploitative.

Child Abuse

All fifty states and the District of Columbia have laws mandating that certain professionals and institutions refer suspected mistreatment, abuse, or neglect to a Child Protective Services (CPS) agency. Each state defines child abuse and neglect based on federal legislation, which defines child abuse and neglect as "any recent act or failure to act on the part of a parent or caretaker which results in death, serious physical or emotional harm, sexual abuse or exploitation, or an act or failure to act, which presents an imminent risk of serious harm" (U.S. Department of Health and Human Services, 2023b).

While all states in the United States have mandatory reporting laws, states do vary in terms of scope. For example, in New York, a nurse who doubts the explanation for a child's injury would have reasonable cause to suspect child abuse and would therefore be required to report it. Some states include specific time frames within which the report must be made—Connecticut, for example, stipulates the report must be made within twelve hours of when the nurse first suspects that abuse has occurred.

To assess a child for abuse, the nurse needs to consider the patient's history, current presentation, and any relevant risk factors. There are screening tools available to the nurse that have been adapted for use in children. The nurse needs to consider the individual child's needs, the clinical setting, and the timing of the assessment when selecting which tool to use.

In addition to the questions asked by screeners that can help identify abuse, the nurse must be aware of the signs of possible abuse when observing the patient. The nurse looks for similar clues in appearance, demeanor, and behavior that they would check for in an older patient. However, the child's age will determine how the nurse conducts the assessment. A nonverbal child will primarily need to be observed and history gathered from the record and caregivers. The nurse notes any concerning findings on the physical exam, such as injuries, as well as any developmental or emotional findings (such as delays). Children who are old enough to converse can be asked simple questions about what they do at home during the day and the people who live in their house with them. For example, you can ask the child to tell what happens at bedtime and bath time, and have them describe their daily interactions with the other people in their household. The nurse can also directly ask a child whether they feel hurt, sick, hungry, or scared. Older children may be able to answer more complex questions, such as discussing how punishments are handled at home, what happens when there are disagreements or fights, and whether they are worried about their safety or the safety of someone else (a sibling or parent). An older child can also be specifically asked if anyone has ever touched them in a way that made them uncomfortable or hurt them.

The nurse needs to notice the dynamic between a child and caregiver. While any young child who has had few experiences with healthcare providers may look to a caregiver often for guidance on how to act or what to say in the clinical setting, this can also represent a controlling, potentially abusive dynamic between the child and adult. The

nurse needs to look for other indicators—such as bruising, signs of neglect, many ER visits for accidental injuries, or somatic complaints of vague, nonspecific symptoms such as stomachaches—to get a more complete picture of the child's experiences.

The abuser may not be the caregiver that brings a child to the appointment. If the abuser has brought the child in, the nurse has a clear opportunity to observe the dynamic. If the other parent has brought the child in, the nurse should be aware that the parent, too, may be abused as well. When speaking to the caregiver, the nurse should observe them for signs of domestic violence or other forms of abuse that could also be affecting the child.

LIFE-STAGE CONTEXT

Sexual Violence against Children

Sexual abuse against children is defined as sexual intercourse with or sexual touching of a child; sexual exploitation; human trafficking of a child; forced viewing of sexual activity; or permitting, allowing, or encouraging a child to engage in prostitution. The following are signs of sexual abuse in children:

- pain, swelling, or itching in the genital area
- bruises, bleeding, and discharge in the genital area
- difficulty walking or sitting
- frequent urination
- stained or bloody underclothing
- sexually transmitted diseases
- refusal to take part in gym or other exercises
- poor peer relationships
- unusual interest in sex for age
- drastic change in school achievement
- runaway or delinquent behavior
- regressive behaviors expected for a younger child

Neglect

In cases of child neglect, a caregiver fails, refuses, or is unable to provide the necessary care, food, clothing, or medical or dental care for reasons other than poverty. Neglect seriously endangers the physical, mental, or emotional health of the child. Signs of child neglect include the following:

- having poor hygiene or body odor
- being inappropriately dressed for the weather
- needing medical or dental care
- being left alone unsupervised for long periods
- appearing malnourished
- being constantly hungry, or begging for or stealing food
- exhibiting extreme willingness to please
- being frequently absent from school
- arriving early and staying late at school, play areas, or other people's homes

Adolescent Relationship Violence

Violence in adolescent relationships is growing in prevalence. In the United States, about 19 percent of teens report being physically, emotionally, or sexually abused by someone they're dating (Abrams, 2023). Harassing someone with unwanted obsessive attention, also known as **stalking**, is a common form of abuse seen in teen relationships.

The nurse can use screening tools to assess teens for current dating violence as well as their risk for experiencing it in the future. Adolescents can be asked direct questions about their relationships, including whether any person they have dated has ever hurt or abused them. As with other people who have experienced abuse or are currently being abused, a teen patient may not speak up out of fear or may try to cover up the abuse. The nurse also needs to use their observation of the patient during the encounter and the patient's history to get a proper assessment. Other risk factors in a teen's life, such as experiencing abuse at home, poverty, and substance use, also need to be taken

into account.

Education is one of the most effective ways of combatting violence in adolescent relationships. The Centers for Disease Control and Prevention (CDC) recommends interventions for families and communities who want to educate their youth on how to avoid violence in their relationships (Figure 20.4).

FIGURE 20.4 Educating teens is the most effective way of preventing adolescent relationship violence. (credit: Centers for Disease Control and Prevention, Public Domain)

Elder Abuse and Neglect

An intentional act or failure to act that causes or creates a risk of harm to an adult aged 60 or more is called elder abuse; this abuse is perpetrated by a caregiver or a person the elder trusts. As with other forms of abuse, elder abuse can be physical, sexual, emotional, or financial.

Elder neglect is the failure to meet an older adult's basic needs, including food, water, shelter, clothing, hygiene, and access to medical care. Older adults are an at-risk population. Therefore, the nurse should continually evaluate these at-risk populations for signs of abuse and neglect.

Bullying in Schools

Using the imbalance of power, children and adolescents who bully others find a way to control or harm others in an aggressive and continual way. The power imbalance can stem from their physical strength, popularity, socioeconomic status, or access to private or possibly embarrassing information about the target of their bullying. Acts such as spreading rumors, purposely excluding a person from a group, physical aggression, and making threats can all be bullying strategies (Stopbullying.gov, 2023).

The nurse can directly ask a child or teen patient if they have experienced bullying, but they should be aware that the patient may be reluctant to answer—particularly if they fear that speaking up will only make the situation worse. Bullying can also be more subtle than other forms of abuse, but that doesn't mean it's not pervasive and serious. The advent of technology, the internet, and social media mean that children can be targeted by bullies not just when they're physically at school, but constantly. The ability of bullying to spread beyond the classroom and playground

has also intensified as more students have become technologically connected.

Caregivers can also provide insight into a child's behaviors, particularly if they have noticed changes that seem related to school. For example, does their child frequently say they feel sick or try to find ways to avoid going to school? Have their grades dropped? Do they no longer hang out with the same friend group or seem isolated?

The nurse should also consider whether the child or teen is in a high-risk group for being bullied—for example, do they have a mental or physical health condition? Do they identify as LGBTQIA+? Are they from a family with low income?

Workplace Violence

Workplace violence includes any act or threats of physical violence, intimidation, harassment, or other threatening behavior happening on the job. Workplace violence comprises verbal or physical abuse and even homicide. According to a recent Bureau of Labor Statistics Census study, workplace violence is currently the third-leading cause of fatal occupational injuries in the United States. Research has identified factors that could increase the risk of workplace violence for some workers on some job sites. Some of these risk factors include working where alcohol is served, working alone, working in law enforcement, and working as a healthcare professional (U.S. Department of Labor, 2022).

The nurse may choose to assess the patient for workplace violence risk when talking about employment. For example, the nurse can talk to the patient about what they do for work and ask them if there are specific stressors or safety concerns related to their occupation. Part of this can be asking about any problems with coworkers, managers, and other employees that could point toward workplace violence.

Negative Implications of Violence and Abuse on Health and Wellness

Any person can be affected by violence and abuse. Whether a patient is the person experiencing the abuse or witnesses someone else being abused, the effects on their physical and mental well-being can be severe and far-reaching. Specific examples of adverse health effects from exposure to violence can include asthma, hypertension, cancer, stroke, and mental illness (U.S. Department of Health and Human Services, 2023a). Children are particularly susceptible to the damaging effects of violence and abuse, which can affect their development.

Risk of Behavioral Issues

People who have experienced abuse are at a higher risk of suffering negative short- or long-term effects as they grapple with what has happened to them. Even if a patient does not currently present with signs or risk factors, the nurse needs to consider the patient's history. Past abuse and trauma may affect the patient in the present assessment.

Behavioral issues are prevalent among people who have experienced violence and abuse, and symptoms of depression, anxiety, insecurity, poor anger management, poor social skills, manipulative behavior, impulsiveness, pathological lying, and a lack of empathy are common.

Risk of Mental Issues

The psychological impact on people who have experienced abuse can be extensive. Nurses often have opportunities to evaluate people with serious mental illness who been abused or perpetrated abuse on others. Studies show clear evidence that people who have experienced violence are at a higher risk for anxiety, depression, and suicidal ideation (Health.gov, 2024).

Depression

Depression is common among people who experience abuse. Everyone goes through times of sadness or feeling blue. If a person feels sad, hopeless, or empty most of the time, for two weeks or more, or if their feelings keep them from their regular activities, however, they may be experiencing depression. People who have experienced abuse may experience depression immediately after the abuse, or the symptoms could appear weeks, months, or even years later.

Suicidal Ideation

Suicidal ideation is a broad term that describes contemplation and preoccupations with suicide. Some people have a very hard time dealing with past violence or neglect; they feel that they are unable to go on living. Common

statements among people with suicidal ideations are:

- “He ruined me.”
- “I’m worthless.”
- “Who would want me after this?”
- “I’m terrified all the time.”
- “I can’t stand my PTSD.”
- “I can never go out in public again.”
- “I’m ashamed that this happened.”
- “People will think I wanted this.”
- “I can never face my family again.”
- “They’d be better off without me.”

People who have endured violence and abuse experience lasting and often profound effects on their bodies and minds. A person who has been abused may grapple with low self-esteem, a loss of identity, shame, guilt, and fear. Memories of past trauma and the lasting effects of it can be intrusive and disabling, preventing a person from living a full life. If they begin to feel hopeless and alone, their thoughts may turn to suicide.

Future Risk of Violent Perpetration

During assessment, the nurse should be aware that a patient who has experienced abuse may have the potential to become an abuser themselves. While they need to assess the patient for signs that they are experiencing abuse, there could also be signs of the patient abusing someone else in turn. For example, a spouse being abused by a partner may become abusive toward their child.

A strong relationship exists between victimization and offending, also known as the victim-offender overlap. While most crime victims do not become offenders, sadly, most offenders have been victims. The National Crime Victimization Survey (NCVS) revealed their findings: Americans experienced 5.4 million violent victimizations. Additionally, children are at a higher risk of victimization than adults are. Sixty-one percent of American minors (under age 17) were exposed to violence in the past year, and 39 percent of children and caregivers reported multiple victimizations (DeLong & Reichert, 2019).

Future Risk of Victimization

If a patient has been abused in the past, the nurse needs to assess their risk for repeated victimization—even if the patient is not currently experiencing abuse. Having been abused in the past places a patient at higher risk for future abuse.

While there are numerous crime prevention programs throughout the United States, many of these programs are utilized by the people who are least likely to be victimized. Most people do not become crime victims, but those who have been victimized face the highest risk of being victimized again. Previous victimization is the single best predictor of future victimization. Repeat victimization is not only predictable but in most cases, repeat victimization occurs within a week of the previous victimization. Some repeat victimization occurs within twenty-four hours of the first. Repeat victimization is prevalent, and it accounts for a large percentage of all crime.

An international victims’ survey reports that 31 percent of sexual assault victims experienced repeat victimization; 56 percent of simple assault victims experienced repeat victimization, and 50 percent of robbery victims experienced repeat victimization (Oudekerk & Truman, 2017).

Future Health Risks

Multiple studies show that people who have experienced violent crime, especially those in the Black or Hispanic populations, are more likely to have certain health risks, including obesity. The correlation between crime victims and obesity is much higher in neighborhoods that experience high rates of violence. Research has also shown that as violent crime rates rise in a neighborhood, the rates of obesity also rise (Stolzenberg & Flexon, 2019).

Nursing Considerations for Patients Involved in Abuse or Violence

Nurses care for patients who are experiencing or have experienced neglect, abuse, and intimate partner violence. Nurses may also experience workplace violence while caring for agitated or combative patients in workplace settings. Nurses therefore should receive ongoing training to spot possible cases of abuse or trafficking as their

patients move through the healthcare system. Any patient may be at risk for violence and abuse, adversely affecting their overall health or ability to comply with a treatment plan. Nurses should present themselves in a nonjudgmental fashion, assuring their patients that they are free to speak with them about anything that is happening in their lives. Nurses should be aware of community and health resources available to at-risk populations along with public health measures that prevent abuse and violence. Nurses should also be aware of legal requirements for reporting violence or abuse (American Medical Association, 2022).

There are a number of abuse screening tools available to the nurse (Table 20.12). Choosing the right tool for each patient requires the nurse to evaluate specific factors such as age and developmental stage and what is already known or suspected about the patient's circumstances based on their history and presentation. For example, an urgent assessment of safety using the Danger Assessment (DA) may be warranted if the nurse is concerned a patient is in immediate danger from intimate partner violence. For patients with more chronic symptoms, an assessment of past adverse childhood experiences (ACEs) that may be contributing to the patient's current presentation can be helpful.

Test	Description
Danger Assessment	This assessment tool helps determine a patient's risk level and measures their threat of being killed by their partner.
MOSAIC	This tool assesses the similarity of a patient's case to other cases with similar attributes. The free test can be used for a variety of situations, including domestic violence and school-based threats.
Adverse Childhood Experience Quiz	This quiz helps assess various types of abuse, neglect, and other symptoms of a difficult childhood.
Ontario Domestic Assault Risk Assessment (ODARA)	ODARA is a risk assessment designed for professional use. The test calculates how a man who has assaulted his female partner ranks among similar perpetrators and helps to determine the likelihood that he will assault again in the future.
Stalking and Harassment Assessment and Risk Profile (SHARP)	This is a free online assessment that takes about fifteen minutes to complete. The patient receives a narrative summarizing their situation and providing steps to improve the outcomes.
SOS Conjugal Interactive Questionnaire	This is a twenty-five-question assessment that identifies different forms of intimate partner violence in a relationship.
Compensation Compass	This tool assists people who have experienced domestic violence in locating resources to assist them in their healing process.

TABLE 20.12 Commonly Used Abuse Screening Tests

Focused Assessment for Violence of General Population

A focused assessment is a detailed nursing assessment focusing on one body system. When performing a full assessment, nurses should include a psychosocial assessment that includes screening for abuse and neglect. Further assessment may be warranted if the patient has specific risk factors that increase their risk for abuse or neglect. Some signs and symptoms of abuse may be obvious, such as a young woman with a black eye. Others may require more critical thinking. Examples include a listless child, a depressed woman having an anxiety attack, or an older adult whose clothes are tattered. These situations require that the nurse apply their critical thinking skills to determine if the patient may or may not be a victim of abuse; it is important to assess, not assume.

Focused Assessment for Violence of At-Risk Populations

An **at-risk population** is a group of individuals at increased risk for health problems and health disparities. Examples of at-risk populations are the following:

- the very young and the very old
- individuals with chronic illnesses, disabilities, or communication barriers
- veterans
- racial and ethnic minorities
- individuals who identify as lesbian, gay, bisexual, transgender, or queer (LGBTQIA+)
- victims of human trafficking or sexual violence
- individuals who are incarcerated and their family members
- rural Americans
- migrant workers
- individuals with chronic mental health disorders
- individuals without homes

These individuals typically have less access to needed health services, resulting in significant disparities in life expectancy, morbidity, and mortality. They are also more likely to have one or more chronic physical and mental health illnesses. Advancing health equity for all members of society is one central goal of public health. Health equity, as defined by the U.S. Department of Health and Human Services, is the "attainment of the highest level of health for all people" and "achieving health equity requires valuing everyone equally with focused and ongoing societal efforts to address avoidable inequities, historical and contemporary injustices, and the elimination of health and healthcare disparities" (Health.gov, 2024).

Nurses should be vigilant in assessing these at-risk populations for abuse and neglect. Many people in a relationship with a person who is abusive are too afraid of the repercussions of coming forward, but the nurse can be an ally by providing a safe, nonjudgmental space in which patients can reach out for help. In many relationships with a person who is abusive, the abuse gets worse as time goes on. Standard practice requires focused assessment, screening, and patient teaching in these situations. A nurse is a **mandatory reporter**, meaning if they witness abuse or know of an abusive situation involving children, older adults, people with disabilities, or anyone experiencing sexual abuse, they must report the abuse or suspected abuse to the authorities. The laws vary by state, so check the laws in your state or municipality.

LINK TO LEARNING

Assessing a child who has experienced abuse is often at the top of a nurse's list of challenging assignments. As a nurse and community member, you play a critical role in handling child abuse. Read this article about the clinical aspects of child abuse (https://openstax.org/r/77ChildAbuseArt) to find out more.

Children

Children have health and developmental needs that require age-appropriate care. During the assessment, the nurse must factor in developmental changes, dependency on others, and different patterns of illness and injury, all of which are unique needs of children in the health system. The nurse needs to use strategies for assessment that are age-appropriate and developmentally appropriate for a child patient. The nurse should be aware that assessing children for abuse can be challenging because of age and developmental factors such as language. For example, a child who is preverbal cannot tell the nurse that they have experienced abuse or answer questions about how they are treated by caregivers. Even older children who are verbal may struggle to understand these concepts and use language to accurately express them.

Any person experiencing abuse may be reluctant to share information or may deny abuse if they fear consequences, but a child may be especially vulnerable to the power that an abuser holds over them—for example, with threats of punishment and consequences.

PATIENT CONVERSATIONS

Displaying Nonjudgmental Listening

Scenario: Blanca is a 32-year-old female visiting a health clinic to get a vaccination. Terry, the registered nurse, will be seeing her today.

Nurse: Hi, Blanca. I've been reading your chart. It says that you're here to update your MMR vaccine, but you also wanted to speak to us about something private. Is that right?

Patient: Hi, Terry. Yes, I don't know who to talk to about this. I'm so upset. But I trust everyone in this clinic.

Nurse: Okay, Blanca, I'm glad you're here. I'd be happy to talk with you about anything that's on your mind.

Patient: Thanks. So, I grew up in a very abusive household. My dad beat my mother and us kids. There were five of us, and Dad had a hard time making ends meet, so he took out his anger on us.

Nurse: I'm so sorry to hear that. Please, go on.

Patient: Well, something happened last week, and now yesterday, that has me really worried. I am seeing a nice man. With my history, I thought he was too good to be true. We do everything together, and I was so happy. We've been together for six months. I finally met his 4-year-old daughter Faith last week. She's a handful. When my boyfriend got an emergency call last night, and he had to go to work for a few hours, I agreed to watch his daughter. She cried and whined when it was bedtime, calling me a stranger. We had played together all day! I finally became so frustrated, I saw red and screamed at her, slamming her door. Thirty minutes later, she opened her door, still crying. I went to carry her back to bed, and I had this strong urge to hold her over my head against a wall and scare her into going to sleep. I didn't do that. Instead, we read a story, and she fell asleep with a smile on her face. I was so ashamed. I didn't physically hurt her, but I had frightened her with my anger. I knew this rage was coming from my childhood beatings. My biggest worry is that I will become an abuser like my father was. To make matters worse, I just found out I'm pregnant. I have to do something to break this cycle.

Nurse: Thank you for trusting me with your story and worries about the future. I have a few ideas. I'd like to refer you to a counselor who only sees patients with a history of abuse. She also has a weekly group you can participate in if you feel comfortable. Are you interested?

Patient: Yes, I'll go. I'll do anything to get better, especially now that I'm having a baby.

Nurse: Let me do a quick exam to find out when this baby is due. We'll talk about the vaccine. It is best to wait until your baby is born to update that one. After your exam, we will work out a plan to address your concerns. We have some great resources.

Patients Who Are Pregnant

Patients who are pregnant represent another at-risk population and also merit extra attention on the part of the nurse in terms of assessing for abuse. Unfortunately, patients who are pregnant and their unborn babies are often caught in a relationship with a person who is abusive. Some partners become abusive because they feel

- angry because this was an unplanned pregnancy,
- stressed at the thought of supporting another person, and/or
- jealous that their partner's attention may shift from themselves to the new baby.

The nurse screens this population carefully for all types of abuse, using tools that are appropriate for the individual patient. Depending on the findings of the assessment, the nurse may need to provide local resources to the patient to ensure their safety and well-being.

Veterans

A veteran is someone who has served in the military forces. When assessing patients who are veterans, the nurse needs to ask about the conditions for which this population is at a higher risk, including mental health disorders, substance abuse, post-traumatic stress disorders, traumatic brain injuries, and suicide. These factors can place veterans at a higher risk for experiencing violence and abuse.

Special Nurse Credentialing: Forensic Nurse Examiners

A sexual assault nurse examiner, or SANE nurse, is a registered nurse or advanced practice nurse specializing in providing health care to people who have experienced sexual assault. SANE nurses are sometimes called forensic nurse examiners. SANE nurses collect forensic evidence, test or treat sexually transmitted infections and HIV, handle concerns about pregnancy, and assist in finding local sexual assault advocacy. SANE nurses can also testify as fact or expert witnesses in a criminal or civil trial (Office of Justice Programs, 2020). SANE nurses typically work in the emergency department (ED). When a person who has experienced sexual assault arrives at the ED, the SANE nurse takes a complete history and a history of the assault, knowing the important legal considerations involved.

REAL RN STORIES

Certifications Matter

Name: Mei, RN
Clinical setting: OB-GYN unit
Years in practice: 14
Facility location: Southern California

Helping people navigate the ups and downs of having a baby or a gynecological procedure has always brought me abundant joy. As a nurse, I've cared for many people who have experienced abuse. The hospital where I work has an ED that seems to be overflowing daily. I wondered how victims of sexual assault could possibly navigate the hospital system after experiencing something so traumatic.

After talking to my manager and expressing my concerns, I learned about a specialized nursing credential called forensic nursing. I paid a fee, studied the materials supplied, and within a few months, sat for the final exam. I was elated when I passed.

After receiving my certification, my manager changed my schedule, allowing me to shadow another forensic nurse in the ED. I loved the work and felt fulfilled in my new practice. I was able to help people find their next steps after a horrific event. My manager worked with the ED manager to create a schedule that allowed me plenty of time in both roles. I love the balance and am thrilled with my new position.

Accurately Documenting Sustained Violence

Documentation of sustained violence is very important, especially if the person hopes to pursue a legal protection order. When there is an established **pattern of abuse**, recurrent and historical abuse, documentation of the history of that abuse is vital in painting a clear picture of the patient's experience. While nursing documentation helps paint a picture of the victim's experience, asking the victim to keep a personal log of incidents will help tell the whole story. The victim's log should contain the following information:

- date of incident
- what the abuser did to them
- time of incident
- what the abuser said to them
- length of time the incident lasted
- how they felt as a result of the incident
- location of incident
- list of witnesses
- name of the abuser
- any other helpful information, such as photos or medical records

In nursing, there is a science to documenting an assessment of abuse in a way that is objective and paints a clear picture of what is happening to the patient. Follow these guidelines when charting signs of potential abuse (Lentz, 2011):

1. Be objective when documenting injuries that could have been caused by domestic violence.
2. Use quotation marks to denote the patient's words or phrases, such as, Patient states, "[patient exact words

here]" or Patient reports, "[patient exact words here]" to quote the patient directly.
3. Avoid speaking in legalese. The nurse's documentation should reflect objective and subjective information but avoid legal jargon (such as using words like *alleged*.)
4. Only identify the person who injured the patient by placing quotations around who the patient names, or use the phrase *as stated by patient*.
5. Avoid writing down any personal conclusions about the situation, such as, "Patient is a battered woman."
6. Do not use the term *domestic violence* or anything similar to describe the patient's diagnosis.
7. The nurse should follow their own observations of the patient's demeanor and overall appearance.
8. Record the time of day the patient was examined and, if possible, indicate how much time has passed since the incident.
9. Write legibly or utilize a computer when charting.
10. Follow the facility's policies and procedures and local laws to report any child, elder, or sexual abuse, or abuse to any at-risk person.

LINK TO LEARNING

The National Domestic Violence Hotline (https://openstax.org/r/77NatDomVioLine) assists people who are experiencing intimate partner violence and provides more detailed information about documenting domestic violence.

Summary

20.1 Mental Health Assessment

This section reviewed the components of a mental health history and mental status examination. The nurse must be able to identify factors that influence a mental health assessment, such as a patient's culture, past experiences with mental health treatment, and communication barriers. The nurse can minimize the impact of these factors by ensuring that patients receive the most comprehensive assessment possible. Nurses must understand their role in performing mental status examinations. By understanding the components of the mental status exam, the nurse will gather data that will serve as the foundation upon which they will develop a comprehensive treatment plan for a patient. Nurses can also implement the interventions from the treatment plan, evaluate the effectiveness of the results, and revise the plans accordingly.

20.2 Substance Use Disorder Assessment

Upon completion of this section, you should be able to verbalize considerations the nurse must use when assessing a patient for alcohol abuse and illicit drug use. The nurse must understand and be able to describe various assessment measures for identifying illicit drug use in a patient. This includes knowing the special considerations that must be taken into account for specific populations when assessing for substance use.

The nurse will be able to describe their role in managing substance abuse. This includes a knowledge of the timeline and symptoms of withdrawal, lab values that may be expected in a patient with substance use disorder (SUD), and planning and evaluating interventions.

20.3 Abuse and Neglect Assessment

This section covered the different types of abuse nurses may encounter when assessing patients, ranging from child abuse and sexual abuse to elder abuse, coercion, and neglect. Nurses should never assume abuse but should learn to recognize obvious signs and symptoms of abuse and should use critical thinking to discern abusive situations that may not be quite as evident. Nurses should also be aware of the numerous negative health implications wrought by abuse. Victims of abuse often deal with physical, behavioral, and psychological problems as a direct or indirect result of their trauma or neglect. There are a number of assessment tools nurses can access to help determine a patient's risk of being abused or resulting health issues. Nurses should be vigilant when treating patients who are considered more vulnerable, such as the very old or young, veterans, and people with disabilities, because they are at greater risk for abuse.

Key Terms

abstract thinking the ability to think about objects, principles, or ideas not physically present
abuse the act of causing physical, emotional, psychological, verbal, sexual, and financial harm to a person
affect physical expression of one's emotional state
akathisia motor restlessness
at-risk drinking alcohol consumption that threatens a person's health, safety, and well-being
at-risk population a group of individuals who are at higher risk of experiencing adverse health, social, or economic outcomes due to various factors
blunted affect dull or emotionless response to emotional stimuli
broad affect the expression of emotions in a healthy, appropriate manner
bullying harassing behavior
catalepsy (also, waxy flexibility) a state of continued unresponsiveness where the patient may be in a fixed body posture for long periods
circumstantial thinking a cognitive style in which speaking and thought processes stray from the original topic before returning to the initial subject matter
coercive control a form of ongoing psychological and emotional abuse based on control, manipulation, and oppression
concrete thinking a cognitive style in which thinkers take the information they can see, hear, or touch at face value and have difficulty applying it beyond the present
congruence consistency between verbal and nonverbal communication

controlled environment an artificial setting that is carefully regulated and monitored to ensure maximum accuracy and precision
delusion a false belief or judgment about reality despite evidence to the contrary
dependence a condition that results in an individual developing a compulsive, chronic reliance on substances for physiological and psychological gratification
distractibility one's attention being quickly drawn to unimportant or irrelevant external stimuli
dyskinesia a movement disorder characterized by uncontrolled, involuntary movements
dysphoric unhappy, depressed, unwell
early remission a period during which a patient who had previously met all criteria for alcohol use disorder has not met the criteria for more than three months and less than twelve months
emotional abuse nonphysical behavior that means to control, isolate, or frighten another person
euphoric feeling a pathologically elevated sense of well-being
euthymic displaying a wide range of emotions that are appropriate for the situation
exploitation the mistreatment of someone to benefit from their work or resources
financial abuse the illegal, unauthorized, or improper use of money, benefits, belongings, property, or assets for the benefit of someone other than the property owner
flat affect significantly decreased or lack of expression of emotion, which is inappropriate for the situation
hallucination false perception involving seeing, hearing, smelling, feeling, or tasting something that is not there
harmful drinking a destructive pattern of alcohol consumption that causes adverse physical, psychological, and social effects
hazardous drinking the excessive or dangerous intake of alcohol, which leads to considerable impairment in physical and mental health
homicidal ideation threats or acts of life-threatening harm toward another person
inappropriate affect emotional expression that is not appropriate for the situation
interpersonal violence the intentional use of physical, sexual, or emotional force against another person
intimate partner violence violence or abuse by a current or former spouse or dating partner
intoxication inebriation caused by the consumption of alcohol or other psychoactive substances, resulting in behavioral and physiological changes
judgment an individual's ability to recognize relationships, draw conclusions from evidence, and evaluate people and situations
labile affect the expression of varying and suddenly shifting emotions
mandatory reporter a healthcare professional who witnesses abuse or knows of an abusive situation involving children, older adults, people with disabilities, or anyone experiencing sexual abuse; they must report the abuse or suspected abuse to the authorities
mental status examination an assessment of a patient's level of consciousness and orientation, appearance and general behavior, speech, motor activity, affect and mood, thought and perception, attitude and insight, and cognitive abilities
moderate alcohol use the consumption of alcoholic beverages per recommended guidelines, typically no more than two drinks per day for men and one drink per day for women
mood short-lived emotional state
mood congruence consistency between the patient's emotional state and their affect
neglect the failure to care for properly
pattern of abuse recurrent and historical abuse
patterned injury a form of physical abuse that leaves a patterned mark on someone
physical abuse the cruel and violent treatment of another person, which can include any sort of physical harm
polypharmacy the simultaneous use of multiple medications, which may increase the risk for interactions and side effects
psychological trauma a person's emotional response to a distressing experience
psychomotor agitation a condition of purposeless, non-goal-directed activity
psychomotor retardation the state of slow physical and mental activity, which may result in extended periods of slow speech, slowness in thinking, and slow physical movements
remote memory distant past memories
restricted affect the expression of reduced emotional expression and intensity

self-concept a person's evaluation of themselves, which encompasses physical and psychological attributes, abilities, and skills, contributing to their sense of identity
sexual violence the act of forcing or manipulating someone into unwanted sexual activity without their consent
stalking harassing someone with unwanted obsessive attention
subdued affect the expression of minimal emotion, lack of spontaneity, withdrawal, and apathy
substance use disorder (SUD) the misuse of drugs or alcohol, which can lead to severe physical and psychological consequences
suicidal ideation thinking about suicide but not necessarily having the intention to act on that idea
sustained remission a period during which a patient who had previously met all criteria for alcohol use disorder has not met the criteria for more than twelve months
tangential thinking disorganized thought processes and a reduced ability to focus attention on the subject at hand
tearful affect being quick to cry, vulnerable, easily overwhelmed
tolerance a built-up resistance of the body to a medication

Assessments

Review Questions

1. The nurse prepares to perform a mental health assessment on a newly admitted patient. The patient's family took him to the doctor with concerns that he believed someone was putting thoughts into his head. After his physical exam, the primary care doctor sent him to the hospital for treatment. What symptom is the patient displaying?
   a. thought blocking
   b. thought broadcasting
   c. thought withdrawal
   d. thought insertion

2. A nurse assesses a newly admitted patient. What observation most concerns the nurse regarding the patient's mental health history?

   a. The patient states he only likes to eat "gozi blather" for each meal and states this is all he will eat while admitted.
   b. The patient mentions that he has thought about suicide for the last few weeks and has collected bottles of pills to "get the job done."
   c. The patient speaks in incoherent, disorganized speech, and his words do not seem to have any meaning.
   d. The patient wishes to tell the nurse about his model train set in great detail.

3. The nurse is preparing to conduct a mental health assessment on a patient who has been on the unit for one week following a suicide attempt. What test would the nurse likely administer?
   a. mental health score
   b. head CT (computerized tomography)
   c. Beck's Depression Inventory
   d. endoscopy

4. The nurse prepares to meet a new patient to administer a mental health assessment. What factor could have an impact on the outcome of the mental health assessment?
   a. It is raining outside, and the patient loves the rain.
   b. The patient is from New York, and the nurse is from California.
   c. The patient expresses that she has had bad experiences with male nurses and requests that all her caregivers be female.
   d. The patient had a dose of Tylenol before coming to the hospital.

5. The nurse is preparing for a day of admissions. He has to perform three mental status exams. What components is he assessing for in the exams?

a. thought generation, happiness survey, speech, mood and affect
b. appearance, behavior, affect, mood, speech, and cognitive performance
c. behavior, happiness survey, family history of cancer, mood, and speech
d. speech, behavior, agility, mood, and thought control

6. The nurse is assessing a 23-year-old male who uses heroin frequently, but he quit "cold turkey" two days ago. What withdrawal symptoms would the nurse expect to see?
a. irritability, attention and sleep problems, depression, increased appetite
b. restlessness, muscle and bone pain, insomnia, diarrhea, vomiting, cold flashes with goose bumps, and leg movements
c. depression, anxiety, tiredness
d. depression, tiredness, increased appetite, insomnia, vivid and unpleasant dreams, slowed thinking and movement, restlessness

7. Laura has just given birth to a baby girl. Laura admits she drinks five to six beers or glasses of wine daily. When the mother and her new daughter arrive on the mother/baby unit, what symptoms might the nurse expect to see in the baby?
a. no appetite, crying, blue hands and feet
b. diarrhea, a red rash covering the body, vomiting
c. low birth weight, difficulty latching on during breastfeeding, did not pass the hearing test
d. large head, extra fingers and toes, high blood sugar

8. A nurse is assessing an 83-year-old newly admitted patient who was transferred from the ER after he suffered alcohol poisoning from drinking a large amount of bourbon the evening before. Now the patient is stable. What assessment tool should the nurse use in his psychosocial assessment?
a. The *DSM-5-TR*
b. SMAST-G test
c. urinalysis
d. forming a hypothesis

9. In a patient's health history, what assessment finding tells the nurse that the patient is experiencing substance use disorder (SUD)?
a. The patient is experiencing withdrawal symptoms when not using.
b. The patient has multiple speeding tickets.
c. The patient states that he is very depressed.
d. The patient has tested positive for marijuana.

10. A 60-year-old female with a history of chronic bilateral hip pain now requires a higher dose of hydrocodone to treat her pain than she did one year ago. What does the nurse assessing her believe this need results from?
a. abuse
b. withdrawal
c. dependence
d. tolerance

11. The nurse visits the home of a 57-year-old male who has diabetes and heart disease. He was seen in the clinic three days ago for wound therapy. When the nurse arrives, she notes that the man's 14-year-old daughter cooks, cleans, and provides her father's care. The nurse inquires about school, and the girl states that her father asked her to take some time off to care for him. She has been out of school for three weeks. What preliminary assessment is noted by the nurse?
a. The daughter is experiencing sexual abuse.
b. The daughter is experiencing neglect.
c. The father and daughter have worked this out, and it is not the nurse's concern.
d. The daughter is experiencing a pattern of injuries.

12. Bill is a nurse working in the ER. His new patient is a 4-year-old male whose mother brought him in for injuries, reportedly caused by falling off the porch. What symptoms indicate that the child may be experiencing long-term abuse?
   a. The patient is huddled under the covers and will not answer any questions.
   b. The patient is wearing mismatched socks.
   c. The patient's x-rays show multiple fractures in varying stages of healing.
   d. The patient states that he does not have many friends.

13. A teacher brings in a second-grade female to the school nurse during lunch. The teacher explains that this student has been acting very fatigued in class, complaining of a stomachache, and refusing to eat her lunches. She never had problems like this until about two weeks ago. When the nurse assesses the student, the child is very guarded in what she shares with them, but does report that an uncle came to stay in her home recently, and he "makes [her] feel uncomfortable." Once the nurse completes an assessment, they note that the child has small blood spots on her underwear. Based on this, what action should the nurse take next?
   a. Remember that a nurse cannot report suspected child abuse unless they have proof.
   b. Make an appointment for the child with her pediatrician.
   c. Reach out to the uncle to hear his side of the story.
   d. Suspect that abuse has occurred and make a call to child protective services.

14. The nurse is seeing a 79-year-old established patient for a routine follow-up visit after a UTI. The patient lives with her daughter and son-in-law. Usually, she is brought in by her daughter but today is accompanied by her granddaughter who is home from college on winter break. The patient completed her prescribed course of TMP-SMX with complete resolution of UTI symptoms. The nurse prepares to take vitals and asks the patient if she needs help removing her bulky winter coat so a blood pressure reading can be taken. When the patient's arm is removed from the sleeve and presented to the nurse, the granddaughter says, "Nana, what happened to your wrist?" The nurse looks down and notes a soft tissue injury encircling the wrist that appears to be consistent with friction or "rope" burn. What is the next step the nurse will take?
   a. Call CPS to report elder abuse.
   b. Ask the patient what happened.
   c. Ask the granddaughter if she thinks the patient is being abused.
   d. Do a more thorough physical assessment to check for other injuries.

15. A nurse works in the ER, and a female seen there often is his next patient. This patient has been seen for a black eye, a dislocated shoulder, and two concussions. She admits that her husband has been abusing her for years, but she is afraid to leave him because it would be difficult for her to support herself. During her assessment, she says, "My mother's dying wish was that I leave him. I may someday." What is the best response from the nurse?
   a. "Do you have any family you can live with? You need to leave him today."
   b. Get the husband's phone number to confront him.
   c. "Will you work with me to put together a safety plan?"
   d. Document the patient's current symptoms and move on.

Check Your Understanding Questions

1. Name three factors that could influence a mental health assessment.

2. What is the nurse's role in conducting a mental health assessment?

3. Describe a condition that develops with chronic use of alcohol, causing an individual to experience withdrawal symptoms if they suddenly stop drinking.

4. Verbalize the difference between early remission and sustained remission concerning alcohol intake.

5. Name three types of abuse and how to assess them.

6. Discuss the recommendations a nurse would provide to a person who has experienced intimate partner

violence who plans to seek a protective order.

Reflection Questions

1. What information might you need to detail regarding a patient who presents with suicidal ideation?
2. As the nurse on duty at the ER, discuss what approach you would take to performing a psychosocial assessment on a patient.
3. You are a school nurse in a middle school. One of your students comes to the office complaining about terrible tooth pain. You look at it and notice that you can see a large cavity on one of his molars. You give him some pain medication and call his mother to advise her of your findings. You tell the mother that her son should see a dentist immediately, and she agrees to take him. A week later, the boy arrives in the office again, still complaining of tooth pain. When you look in his mouth this time, you see an abscess has formed. You decide to call the dentist's office and schedule an emergency appointment for the patient. You call the mother to advise her of the appointment, and she is grateful. Three days later the student arrives in your office complaining of the same symptoms, only this time he has a temperature of 102.7. What is the best course of action? Describe situations other than abuse or neglect that could have made it difficult for this mother to take her child to the dentist.

What Should the Nurse Do?

1. Tonya is a nurse at a busy level-one trauma center. Working in the ER, she sees all types of patients. Her new patient, Lin, is a 24-year-old female who complains of having trouble leaving her home because the local radio station can access her brain and broadcasts her thoughts to the whole town. Her family convinced Lin to visit the ER to address her symptoms. The nurse knows that she needs to assess Lin for mental illness, but Lin is afraid of the loud noises in the ER and is not sure she trusts Nurse Tonya with her secrets. What should the nurse do?

Lucy is a 19-year-old female who lives at home with her mother. She assists her mother in caring for her grandfather who has dementia and is a hospice patient. She recently lost her grandmother and father to cancer and has a strained relationship with her mother. Lucy has a long history of severe anxiety and depression. She has taken several antidepressants in the past, but she stopped taking them a month ago and her symptoms returned. Lucy says she does not like how the medications give her a dull outlook on the world. Lucy is an artist who feels she cannot create art while her senses are clouded by medication. Lucy was brought to the ER by ambulance shortly after midnight. She had taken all of her grandfather's hospice medications, including an entire bottle of morphine, a whole bottle of Ativan, and a compounded cream called HABR, containing Haldol, Ativan, Benadryl, and Reglan prescribed for treating intractable nausea. Lucy admits to ER staff that she initially drank a bottle of wine and intended to end her life with the medications. Lucy has had two previous suicide attempts and has a history of substance use disorder since she was 13. She currently uses marijuana, mushrooms, ecstasy, and cocaine regularly.

2. What factors are contributing to Lucy's physical and mental well-being?
3. What is the main reason that Lucy is not complying with treatment?
4. Lucy's nurse is putting together a treatment plan for her. What issues should be addressed in the nurse's treatment plan?

Molly is a 15-year-old female who ran away from home two weeks ago. She was found asleep on a sidewalk and the police brought her in to have her evaluated because she complained of right-side pain and bruising in her ribs and chest. While getting her settled and performing an assessment, the nurse notices that she is guarding her right side and taking only shallow breaths. The physician orders labs and a chest x-ray. The chest x-ray shows a displaced fracture on the right rib cage and two older, healing fractures on her left rib cage. After seeing the x-ray results, the nurse speaks to Molly to gather more details about her history and to inquire about how the injuries occurred. Molly tells the nurse that her stepfather Shane gets mad sometimes when she forgets to do chores and that he sometimes becomes violent when he's angry. When the nurse asks about Molly running away from home, Molly only says, "It was best for all of us if I left. There are too many mouths to feed, and half of us didn't get to eat most nights."

5. What would be an appropriate way to document the patient's visit to the ER?
6. What facts were you able to note in Molly's story?
7. Write a list of information you will give Child Protective Services when you call.

8. Home health nurse Faith cares for Tony, a homebound veteran who has rheumatoid arthritis, diabetes, and COPD. He lives with his daughter and her boyfriend in a rural area with limited access to medical care, so he is pleased to have Faith come twice a week to bathe him and change his dressings. Faith arrives one day to find Tony on the bathroom floor, and no one else is home. Tony told her he had fallen yesterday morning and that no one was there to help him. He had spent all night and most of the day lying on the cold floor. When Faith asked about his family members, Tony told her they always do this. He said they sleep here sometimes but they like to stay out at night barhopping. After getting Tony up and assessing him for injuries, what should the nurse do?

Competency-Based Assessments

1. Develop a fifteen-minute presentation discussing the nurse's role relating to the different types of mental health scales.
2. In groups, take turns acting as the nurse and the patient. Role-play a substance abuse assessment. Then as a group, discuss the steps of the nursing process and how each step should be applied to your scenario. If you do not have other students to work with, write the scenario out from both perspectives—the nurse and the patient.
3. Write a list of questions you would ask as a nurse caring for a child who is possibly experiencing neglect.
4. Review the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 21

Assessment of the Integumentary System

FIGURE 21.1 Nursing knowledge related to a comprehensive assessment of the integumentary system is imperative for providing quality patient care. (credit: modification of work "22-0006-041 skin cancer check_725" by Navy Medicine/Flickr, Public Domain)

CHAPTER OUTLINE

21.1 Structure and Functions of the Skin

21.2 Factors Affecting Skin Integrity

INTRODUCTION The integumentary system is an essential component to every healthcare encounter. The condition of an individual's skin, hair, and nails provides important information about their physical and emotional health. The structures of the integumentary system play significant functions in the body and reflect dysfunctions from other body systems. For example, someone with inadequate perfusion may have a cyanotic, or blue, appearance to their skin. Thus, when a nurse notes this abnormal skin appearance, appropriate interventions can be identified and implemented to promote optimal outcomes. Therefore, nurses must be competent in the anatomy and physiology of the integumentary system to adequately develop a plan of care, identify potential risks, and implement appropriate nursing interventions. The nurse must also have knowledge of factors affecting skin integrity, wounds, and wound management.

21.1 Structure and Functions of the Skin

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Review the anatomy of the integumentary system
- Identify the many functions of skin
- Recognize how assessment findings may vary in special populations

The integumentary system is the body's first line of defense, serving as a physical barrier between the external and

internal environments. The external environment includes microorganisms, radiation, temperature, or other threats of physical trauma or injury. The internal environment is the body that the integumentary system serves to protect and maintain homeostasis. The integumentary system includes the skin, hair, nails, as well as glands (e.g., sebaceous, sweat, mammary) (Kim & Dao, 2023).

Nurses play a vital role in maintaining skin integrity and promoting wound healing. To effectively protect and preserve a patient's skin, the nurse must understand the anatomy and physiology of the integumentary system, factors affecting skin integrity, and how to appropriately manage wounds.

Anatomy of the Skin

The skin, which covers the body entirely, is the largest organ of the body. It serves as a protective barrier against heat, light, infection, and injury and performs additional essential functions. The skin varies in thickness, color, and texture across the body. For example, the palms of the hands and soles of the feet are thicker than skin on the abdomen. The skin is made up of three distinctive layers: the epidermis (the outermost layer of the skin); dermis (the layer below the epidermis); and hypodermis or subcutaneous tissue (the deepest layer) (Figure 21.2). Each layer varies in its anatomy and function (Yousef et al., 2022).

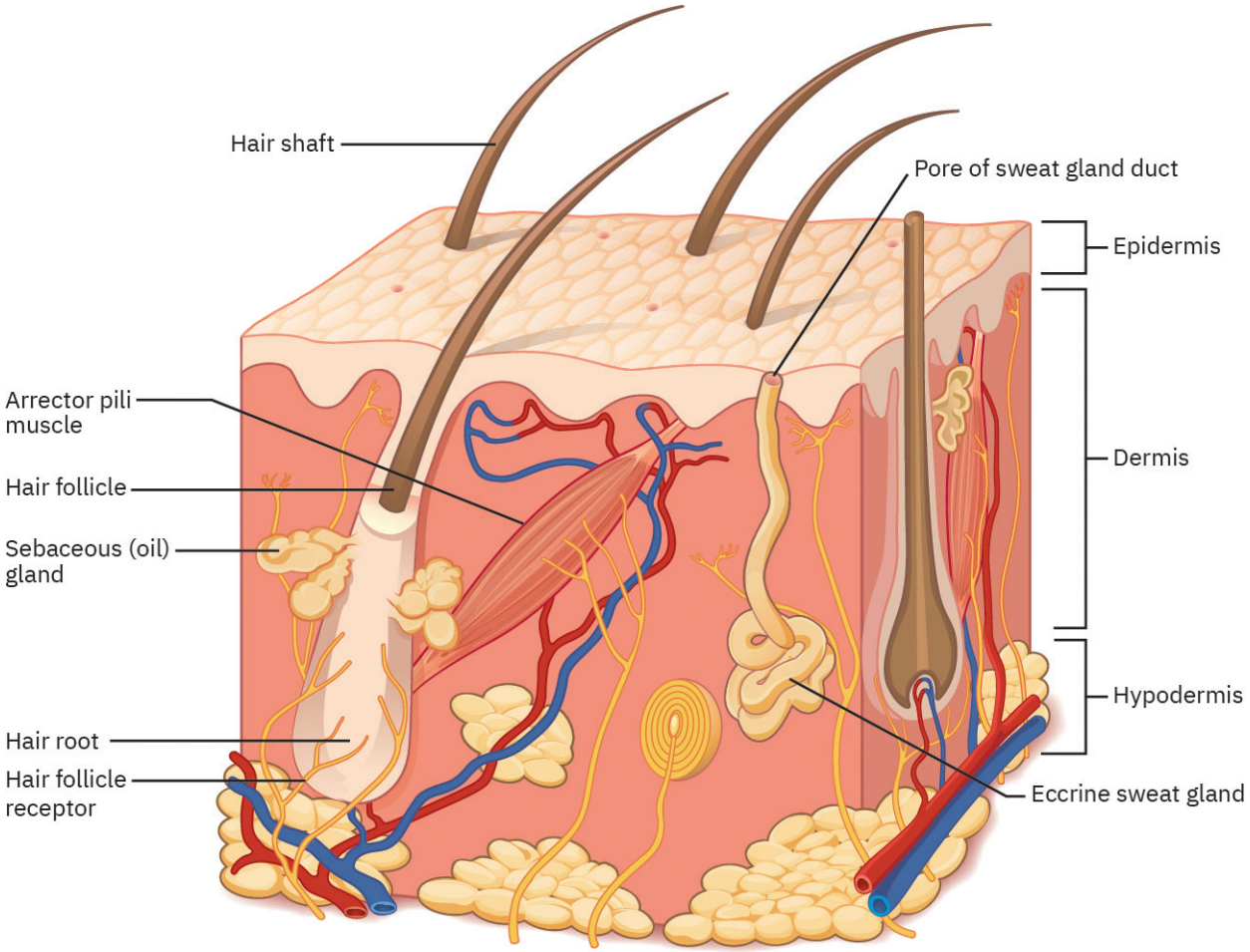


FIGURE 21.2 The skin is composed of the epidermis, dermis, and hypodermis layers. The nurse must be competent in the anatomy of the skin to adequately assess and manage an individual's skin integrity. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Epidermis

The epidermis is the thin outer layer of the skin and consists of epithelial cells. The main function of the epidermis is to protect deeper tissue layers from water, mechanical and chemical trauma, exposure to microorganisms, and damage from ultraviolet (UV) light. The epidermis has four or five layers depending on its location (Figure 21.3). There are five layers over the palms of the hands and soles of the feet, while the rest of the body has four layers. Starting from the bottom, the layers are the stratum basale, stratum spinosum, stratum granulosum, stratum

lucidum, and stratum corneum.

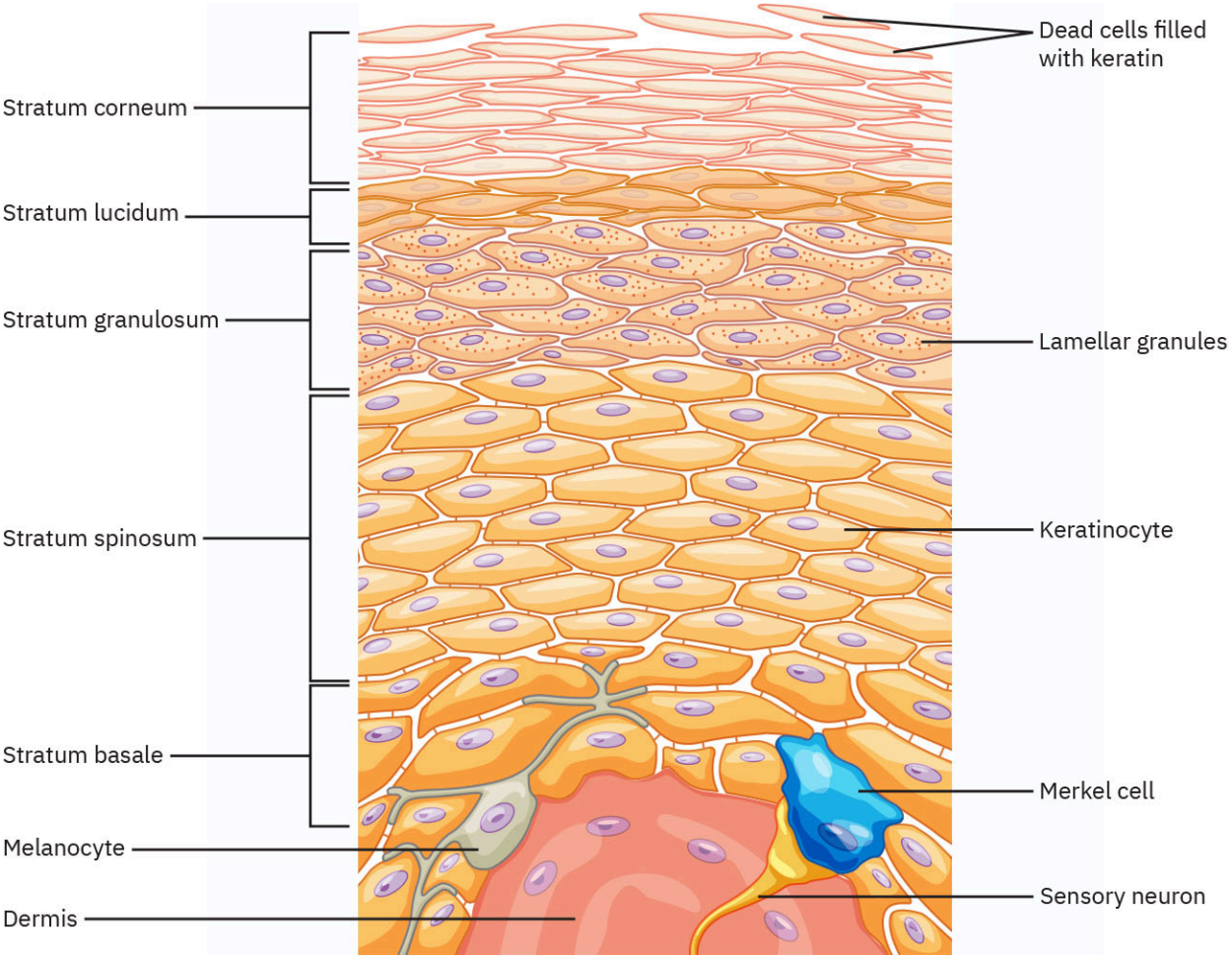


FIGURE 21.3 The epidermal layers include the stratum basale, stratum spinosum, stratum granulosum, stratum lucidum, and stratum corneum. The stratum lucidum is only present in the soles of the feet and palms of the hand. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

The **stratum basale** (or stratum germinativum) is the deepest layer of the epidermis and contains a cell known as a **melanocyte** that produce **melanin** and a **keratinocyte** that produces **keratin**. Melanin forms a protective shield to protect the keratinocytes and nerve endings from damage caused by ultraviolet light. Melanin is also responsible for the color of the skin. Keratin is a fibrous, water-repellent protein that gives the epidermis its strong, protective quality. The keratinocytes move upward through the layers as they mature and become dead cells on the outermost layer of the skin (Osseiran et al., 2018). The **Merkel cell** is also found in the stratum basale and serves as a sensory receptor for light touch.

The next layer above the stratum basale is the **stratum spinosum**. This layer is several layers thick and contains cells that arise from the bone marrow and move up to the epidermis. The cells are "irregular, polyhedral cells with cytoplasmic processes and are often called 'spines' that extend outward and contact neighboring cells by desmosomes" (Yousef et al., 2022). The **Langerhans cell** is primarily located in the stratum spinosum. These cells are first-line defenders and are antigen-producing cells that determine the appropriate response to (e.g., inflammation) or tolerance of foreign substances.

The next layer, the **stratum granulosum**, is only two to three cell layers thick. This layer contains a glycolipid that slows water loss across the epidermis. The process of **keratinization**, a thickening of plasma membranes of a cell, begins in this layer. The next layer, the **stratum lucidum**, is only found in the thicker areas of the skin (e.g., palms and soles of feet). It is two to three cell layers thick and is made up of flattened, dead keratinocytes. The outermost layer of the epidermis, the **stratum corneum**, is the thickest layer and makes up about 75 percent of the total thickness. This layer contains dead keratinocytes that secrete **defensin** (a class of host-defense peptides found in

neutrophils that have antimicrobial and/or cytotoxic properties) and is part of the body's first immune defense.

Dermis

The second, deeper layer of the skin is the **dermis,** which is connected to the epidermis by dermal papillae. Its main function is regulating temperature and supporting, protecting, and nourishing the epidermis. This layer consists of the **papillary layer** and **reticular layer**. The upper papillary layer is the thinner of the two and is composed of loose connective tissue and contacts the epidermis. It also contains capillaries as well as touch and pain receptors. The deeper layer, the reticular layer, is the thicker of the two. This layer consists of dense connective tissue, collagen bundles, and houses most of the sweat glands, sebaceous glands, hair follicles, hair, muscles, blood vessels, and deep sensory neurons (Yousuf et al., 2022).

The **sebaceous gland** is attached to the hair follicles and is present over the body minus the palms of hands and soles of feet. The sebaceous glands secrete sebum, an oily substance that makes the hair and skin waterproof. There are two types of sweat glands: eccrine glands and apocrine glands. The **eccrine gland** is located over the skin entirely, secretes sweat, and aids in thermoregulation. The **apocrine gland** correlates with the hair follicles present in the perineum, axillae, and areolae of the breasts. These glands are nonfunctioning and small until puberty has been reached. After the onset of puberty, the glands secrete a milky sweat.

Hypodermis

The **hypodermis** (**subcutaneous tissue**) is the subcutaneous fatty layer beneath the dermis that separates the skin from the underlying tissue. The hypodermis also anchors the dermis to the underlying tissues of the body and insulates, protects, and stores fat for the body. This layer is made up of loose connective tissue and stores about half of the body's fat cells. This layer provides a cushion for the body against trauma, stores fat for energy, and insulates the body from heat loss. Some skin appendages (e.g., hair follicles, blood vessels, sensory neurons) are found in the hypodermis. This layer also contains blood and lymph vessels and nerves. The blood vessels supply nutrients to the tissues, and the lymph vessels provide a pathway for the movement of waste products to and from the skin.

Functions of the Skin

The skin performs essential functions including protection, thermoregulation, sensation, absorption, elimination, and vitamin D production. The skin contributes to the psychosocial aspect of an individual because of its contribution to the external appearance of the person and plays a role in self-esteem. The skin also aids in communication with the brain via the sensory neurons located in the skin.

Protection

The skin provides protection because it covers the body entirely and serves as the physical barrier between the internal and external environments. Breaks in the skin trigger an immune response to promote healing and fight off foreign debris that may lead to infection. The many layers of the skin provide protection from injury to underlying tissues and organs. The skin also acts as a shield from microorganisms, damaging ultraviolet rays, and other substances including water. The layers of keratin and glycolipids in the skin serve to protect the body against moisture loss from both the surface and underlying structures.

Thermoregulation

Temperature regulation is another function of the skin. The skin is highly vascularized, which allows the body to regulate body temperature through vasoconstriction and vasodilation of blood vessels. When body temperature decreases, blood vessels vasoconstrict to decrease blood flow to the periphery in an effort to conserve core body heat. The **arrector pili muscle** triggers hair follicles on the body to flex causing the hair to rise up (goosebumps), which further prevents heat loss (Figure 21.4). When body temperature increases, blood vessels vasodilate to increase blood flow. Sweat is secreted, which evaporates from the skin contributing to heat loss and bringing the body temperature down (Kim & Dao, 2023).

FIGURE 21.4 The arrector pili muscles pull hair upright in an attempt to prevent heat loss; this is also part of the fight-or-flight response of the sympathetic nervous system. (credit: modification of work "Goose bumps.jpg" by "Everjean"/Wikimedia Commons, CC BY 2.0)

LIFE-STAGE CONTEXT

Thermoregulation and Newborns

During the first hours of life, newborns experience difficulties regulating their body temperature. The balance of heat production and heat loss is linked to the metabolism and oxygen consumption of the newborn. Newborns can attempt to conserve heat and increase their heat production by increasing peripheral vasoconstriction, metabolic rate, and muscular activity through moving. Newborns may also assume a fetal position to hold in heat and decrease body surface area exposure. Nursing interventions to aid in maintaining body temperature of newborns include the following (Albahrani & Hunt, 2019):

- Dry newborns completely after birth or baths to prevent heat loss through evaporation. (Baths should be performed after newborn is stable, and a radiant heat source should be used.)
- Prewarm blankets and caps to reduce heat loss through conduction.
- Place a cap on a newborn after drying thoroughly.
- Use a warm cover on the scale when weighing a newborn.
- Warm stethoscopes and hands before touching a newborn.
- Avoid placing a newborn near air vents or areas with drafts, and avoid placing cribs near cold outer walls.
- Keep infant transporter fully charged and heated.
- Avoid placing skin temperature probes over brown fat areas (found on the back, neck, and shoulders in babies to help regulate body temperature).
- Encourage parent skin-to-skin contact with stable newborns.
- Use heated and humidified oxygen.

Sensation

The skin provides sensation for the body and allows a patient to feel temperature, pressure, pain, and touch through the various sensory nerve endings. Each type of sensory receptor sends signals to the brain and spinal cord that allow a patient to respond and adjust to the environment as needed. For example, when a patient touches something that is extremely hot, they typically move their hand away quickly, which is the body's reflex in response

to the external stimuli in an effort to protect itself from harm.

PATIENT CONVERSATIONS

Older Adults and Decreased Sensation

Scenario: A nurse is assessing an older adult with diabetic neuropathy who is being seen in the clinic for a sore on his right foot.

Nurse: Hi. My name is Linda, and I will be your nurse today. Will you tell me your name and date of birth?

Patient: Yes. Hi, my name is Joseph Gellar. My date of birth is April 25, 1941.

Nurse: Thank you. What brings you in today?

Patient: Well, I have this sore on my foot, and I am not sure how I got it.

Nurse: Okay, let me take a look.

Nurse: [after assessing the wound] Let's verify your health history.

Patient: Well, I have diabetes, high blood pressure, and high cholesterol.

Nurse: What medications do you currently take?

Patient: I take my insulin, metoprolol, and atorvastatin. But I forgot to check my blood sugar today and take my insulin.

Nurse: Okay, have you noticed any changes in sensation? Like being able to feel things that are painful, hot, or cold?

Patient: Yeah, I noticed that a few years ago, but I just thought it was normal.

Nurse: Diabetic neuropathy is common with uncontrolled blood sugar and high levels of fat that can cause nerve damage. Because of this, it is important to be aware of your surroundings to avoid injury. Check your feet every day for any injuries like cuts, scrapes, or bruises. It is also important to try to manage your blood sugar as much as possible with your diet, exercise, and medications.

Patient: Oh, that makes sense. I think my wife and I have a friend who had something similar happen.

Nurse: Yes sir. Do you have any questions for me before I give an update to your doctor, so he can come in and see you?

Patient: No, that will be it for now.

Nurse: Okay, great. I will be in after the doctor sees you to go over any orders or treatments he prescribes for you.

Absorption

The skin is porous and therefore absorbs substances that may be on it. Substances that can be absorbed through the skin will enter the bloodstream. Certain medications may be absorbed by **transdermal administration** (placed on the skin and absorbed either locally or systemically), including scopolamine, estrogen, testosterone, some opioids, nicotine, and some contraceptives. It is important to note that anything on the skin may be absorbed and thus has the potential to cause harm. Certain chemicals and medications require appropriate handling to avoid the risk of harm or injury. For example, when administering fentanyl, it is important to wear gloves to avoid accidental absorption into the bloodstream. This is also why sunscreen or other lotions are not used on babies under 6 months old due to thin skin and increased absorption.

Elimination

The elimination function of the skin helps the body get rid of excess water and salts through sweat produced by the sweat glands. This **perspiration** or sweat may contain electrolytes, water, and nitrogenous wastes like urea, uric acid, and ammonia. In the event other organs become unable to eliminate toxins, the skin will try to push out toxins to aid in removal. In addition to removing wastes, the excretion function of the skin aids in regulating body temperature as previously described.

Vitamin D Production

The skin initiates the biochemical processes necessary for vitamin D production. Ultraviolet sun exposure leads to the conversion of 7-dehydrocholesterol to cholecalciferol (vitamin D_3) in the skin. Cholecalciferol is hydroxylated in the liver and then in the kidneys, which converts it into the active, metabolite form, calcitriol. The chemical process in which a hydroxl group (–OH) is introduced into an organic compound is termed **hydroxylation**. This metabolite leads to enhanced calcium production in the gut and is vital for bone health (Kim & Dao, 2023).

Assessment Findings for Special Populations

There are distinct considerations for special populations that the nurse must consider when assessing a patient's skin. The assessment's findings may vary among different cultures and ethnicities, developmental levels, and age groups. It is essential that the nurse be aware of the variations when performing a skin assessment to avoid stereotypes and to ensure accuracy when developing a plan of care to promote optimal outcomes. For example, a darker-skinned patient may not show pallor in the same way a lighter-skinned patient would. The nurse must assess the mucous membranes, such as the gums or palpebral conjunctiva, of a darker-skinned patient to adequately assess for pallor.

REAL RN STORIES

Identifying Dermal Melanocytosis

Name: Bailey, BSN
Clinical setting: Pediatric clinic
Years in practice: 3
Facility location: Rural area of Kansas

Our pediatric clinic is the only one in a 50-mile radius so we are always swamped. One day, I was working in the well-baby side of our clinic. I was assessing a baby who was here for her six-month wellness visit. Her mother, Ali, brought her in and introduced her baby girl as Alexis. After taking her medical history, I began the physical assessment. I noticed what appeared to be bruises along Alexis's back similar to those seen in abuse cases (Figure 21.5). I was concerned and thought that the baby may be experiencing abuse at home. The spots were bluish in color and along the baby's backside, so the areas were not visible to others.

As I began to plan my next steps, Alexis's mother stated, "I am ready for the spots to start disappearing!" Then, I recalled learning about these spots in nursing school. I put my fingers on the skin to blanch the area and was relieved when I observed that the spots were nonblanchable, confirming dermal melanocytosis, formerly known as Mongolian spots. The spots are actually pigmented skin lesions that may be present at birth or develop within the first few weeks of life.

I asked Ali about the first noticeable spot and said they showed up when Alexis was about 2 weeks old. We then discussed how the spots may disappear by childhood. Ali said she understood but would be happy when they were gone. It was the first time I had actually seen Mongolian spots, and I was really relieved that they were not bruises from abuse.

FIGURE 21.5 Dermal melanocytosis presents as pigmented skin lesions that may be present at birth or develop within the first few weeks of life. (credit: "Mongolianspotphoto.jpg" by "abby lu"/Wikipedia, CC BY 2.0)

Cultural Considerations

While people share a similar number and distribution of eccrine glands over the body, the glands vary in activity depending on patient-specific characteristics and environmental adaptations. For example, those born in tropical areas have more functioning eccrine glands than those who move there later in life. People who acclimate to hot environments do not excrete as much chloride in their sweat as others. People of Asian and American Indian descent have fewer functioning apocrine glands than Whites and Blacks. The amount of sweat and body odor an individual has is genetically determined and is in relation to the functionality of the apocrine glands. Therefore, Asians and American Indians have little to no underarm sweat or body odor. People born farther from the equator usually have fairer skin and are at a greater risk of developing skin cancers due to lower levels of the protective pigment, melanin. Additional factors for fair-skinned individuals include the presence of freckles and an increased susceptibility to sunburn. However, all people with excessive levels of sun exposure are at risk for sun damage to skin and skin cancer and should, therefore, avoid excessive exposure to UV light. Darker-skinned patients, including those of ethnicities such as Black, Latinx, Hispanic, Asian, and American Indian, typically produce more melanin in general. The higher level of melanin is a protective factor and reduces the risk of developing skin cancers. However, darker-skinned individuals are more susceptible to certain skin abnormalities (Figure 21.6), including the following:

- **postinflammatory hyperpigmentation**, a temporary pigmentation that occurs after an injury or inflammatory skin condition, most commonly seen in patients with darker skin types
- **dermatosis papulose nigra**, small dark or skin-colored bumps on the face, neck, and upper torso, common in patients with darker skin colors
- **keloid**, a thick fibrous scar caused by excessive collagen formation in response to trauma or a surgical incision
- **pityriasis**, any of various skin conditions characterized by dry scaling patches of skin
- **vitiligo**, a chronic autoimmune disorder that causes partial or total loss of skin color in patches
- hair loss
- dry skin

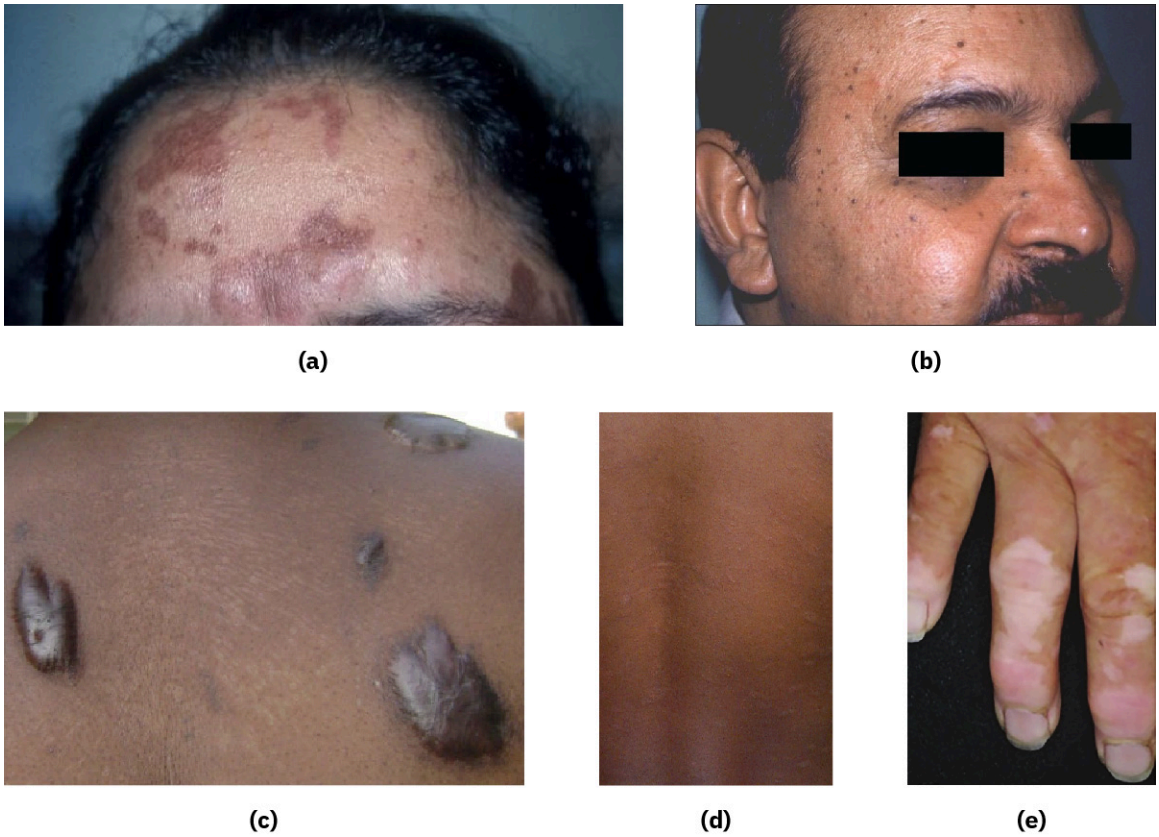


FIGURE 21.6 (a) The skin abnormalities are as follows: postinflammatory hyperpigmentation, (b) dermatosis papulosa nigra, (c) keloids, (d) pityriasis, and (e) vitiligo. (credit a: modification of work "Post inflammatory hyperpigmentation" by "Kylie Aquino"/Flickr, Public Domain; credit b: modification of work "Dermatosis papulosa nigra effectively cleared with laser" by National Library of Medicine, CC BY 2.0; credit c: modification of work "Untitled" by National Library of Medicine, CC BY; credit d: modification of work " Pityriasis rosea 1.JPG" by Mike Blyth/ Wikimedia Commons, CC BY 3.0; credit e: modification of work "Becker Cassisi hand 1, before.png" by Stacie J. Becker & Jeffrey E. Cassisi/ Wikimedia Commons, CC BY 4.0)

Developmental Considerations of Infants and Children

A person's skin undergoes changes throughout the life span. Sebaceous glands do not function maturely at birth. Sebum production increases in the prepubescent and adolescent years, which makes individuals within these age ranges more prone to acne. The sweat glands of an infant function to some degree and produce sweat in response to heat or emotional stimuli. By the time the child reaches middle child years, the sweat glands are fully functional. Until the glands function fully, temperature regulation is not as efficient as it is with the fully functioning glands of older children and adults.

Infants also have a thinner epidermis than adults. Infants have less subcutaneous tissue, so the blood vessels lie closer to the skin's surface. Therefore, an infant loses more heat through the skin's surface than an older child or adult. In addition, substances absorb more readily through the skin of an infant than an adult because of the thinness of the skin. Infant skin contains more water than adult skin. The epidermis is loosely bound to the dermis, and this means that friction may easily separate the layers which can result in blisters or skin breakdown.

Regardless of ethnicity, infant skin is less pigmented, and this places them at higher risk of skin damage from sun exposure. As the infant ages, the skin becomes tougher and less hydrated, making them less susceptible to invasions from microorganisms. When the child reaches teenage years, the skin characteristics and thickness are at the adult level. Infant skin and mucous membranes are more easily injured and susceptible to infection; therefore, the nurse must carefully handle infants to protect them from harm or infection.

LIFE-STAGE CONTEXT

Overheating Infants

Overheating an infant can easily happen if a caregiver fears that the infant is cold. Newborns and infants do not have a mature thermoregulatory system. This means that they are more vulnerable to overheating. Signs and symptoms of overheating include the infant

- feeling warm to the touch;
- having flushed or red skin;
- developing heat rash;
- sweating or having damp hair;
- developing tachycardia;
- developing tachypnea;
- acting fussy;
- appearing sluggish, confused, or dizzy; or
- becoming unresponsive.

Nurses should be aware of these signs and the interventions needed: administer fluids (e.g., breast milk, water, or formula depending on their age), apply cold compresses, take off any excessive clothing or bedding, and go to a well-ventilated area. If the nurse is educating a caregiver, they should also include the need to call 911 if the child is unresponsive. Interventions to prevent overheating include avoiding the use of excessive clothing and bedding, keeping the room temperature between 68°F and 72°F (20°C and 22°C), ensuring adequate room ventilation, using curtains if needed to block out excessive light and heat, and avoiding the use of heating pads.

Other developmental considerations the nurse must consider include patients with cognitive disabilities. Individuals with cognitive dysfunction may not know how to check their own skin for abnormalities or impairments, or they may not recognize any changes in their skin. These patients may also neglect skin care. This can lead to itching, scratching, and picking because of buildup of dead skin and other debris, which can lead to injury or infection. The nurse may need to establish rapport with those who have disabilities to gain their trust. This enables the nurse to perform an assessment and provide coaching to teach them how to perform a skin assessment at home. If a patient with a disability has a caregiver, the caregiver should be included in education of skin assessment as well as findings to report.

The nurse must also consider the patient's developmental level when communicating and when describing the steps of assessment. For example, an infant may be examined in the caregiver's lap versus the school-aged child who can sit on the examination table. The nurse should speak with terms that are appropriate for the age or developmental level. The nurse should also speak to the patient regardless of the developmental level, especially school-age children and adolescents, to help them feel included in the plan of care.

Age-Related Considerations

Much like the infant's skin changes from birth to adulthood, the skin continues to change as a person ages (Figure 21.7). The thickness of the epidermis in older people decreases, making the skin more delicate and at risk of tears or injury. The subcutaneous tissues also become thinner, making thermoregulation more difficult and increasing the risk of pressure ulcers. The **mitotic activity**, or the degree in which a population of cells proliferates, decreases, leading to delayed wound healing. As the subcutaneous and dermal tissues thin with age, the skin becomes more prone to wrinkles, and pressure and pain sensation is reduced.

FIGURE 21.7 Aging is a normal part of life and includes skin changes. The skin layers become thinner and less elastic, making the skin more prone to wrinkles and impaired skin integrity. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

As the activity levels of the sebaceous and sweat glands decrease, the skin becomes dryer, and older people may experience **pruritus**, itching. Melanin declines with age leading to unevenly pigmented skin and gray or white hair. Hyperplasia of the melanocytes may lead to small areas of **hyperpigmentation**, darkened patches of skin called liver spots. Decreased melanin in an area can cause **hypopigmentation**, lighter patches of skin (age spots). The elastic fibers degenerate causing the skin to lose its elasticity. There is often a redistribution of adipose tissue leading to cellulite (lumpy skin), increased abdominal fat, sagging of breasts, and reduced **tenting** (the skin does not snap back when pinched; instead, it maintains a tentlike shape, which may indicate dehydration). Decreased vitamin D production, which is normal with aging, increases the risk of **osteomalacia** (bone demineralization) and osteoporosis (decrease in bone mass and density).

21.2 Factors Affecting Skin Integrity

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify risk factors for impaired skin integrity
- Examine common skin disorders that cause impaired skin integrity
- Describe health promotion behaviors related to skin integrity

Skin integrity refers to the overall health of the skin. Factors that influence healthy skin are patient specific. These factors include age, genetics, and overall health. For example, the skin color of a patient of Asian descent will appear different from that of a patient of Eastern European descent. In addition, skin changes as people age, so the nurse must consider age when assessing a patient's skin. It is crucial that nurses obtain the patient's health history and perform an assessment to identify risk factors for impaired skin integrity to effectively implement nursing interventions and provide education to patients and families. The nurse must be aware of common skin disorders that can lead to impaired skin integrity as well as health promotion behaviors related to skin integrity.

Risk Factors for Impaired Skin Integrity

When the skin is healthy and unbroken, the skin is able to efficiently carry out its functions. Resistance of the skin and mucous membranes to injury varies among patients and is dependent on factors including age and medical conditions. Patients with adequate nutrition are also more resistant to injury or disease. Adequate perfusion is vital in maintaining cell life. When skin integrity is impaired, cells do not get the nourishment they need and cannot eliminate wastes effectively. To identify risks for impaired skin integrity, the nurse must examine lifestyle and behavioral factors as well as genetic and state of health factors.

Lifestyle and Behavioral Factors

Lifestyle and behavioral factors that affect skin integrity include a patient's nutrition, activity levels, sexuality, medications used, illicit drug use, body piercings, tattoos, and substances that come in contact with the skin like soaps, detergents, and lotions. Nutrition plays an important role in the health of a patient's skin. Inadequate nutrition may lead to skin breakdown, delayed wound healing, premature aging of the skin, inflammation, dryness, and changes in hair. A patient's exposure to the sun or other UV light may place them at risk of skin cancer as a result of prolonged exposure. A patient's activity levels may also place them at risk of other injuries (e.g., abrasions, burns, bruising) depending on the type of activity. For example, hikers may fall and be prone to abrasions or bruising.

Patients who engage in risky sexual behavior (e.g., having unprotected sex, having multiple partners) are at a higher risk of contracting sexually transmitted infections. Human immunodeficiency virus (HIV), acquired immunodeficiency syndrome, and hepatitis C are three common sexually transmitted infections. People with hepatitis C may experience discoloration or jaundice (yellowing of skin and mucus membranes), swelling, itching, and hives. People who inject illicit IV drugs or share needles with other people also are at risk of these and other infections. They may also develop **Kaposi sarcoma**, which is a rare type of cancer caused by a virus. It may appear as a red or blue patch, similar to a bruise, and is often found on the skin or inside the mouth. Body piercings or tattoos may place patients at risk of bacterial or viral infections, deformities, scarring, and nerve damage (van der Bent et al., 2021).

The use of certain types of hygiene products may also place a patient at risk of impaired skin integrity. Certain types of soaps, lotions, and detergents may be too harsh for a person's skin based on their age, health condition, and genetics. Some detergents and soaps increase the pH levels of the stratum corneum, and those products may cause rashes, inflammation, dermatitis, and acne breakouts. Older people who do not use an **emollient** (an ingredient that soothes dryness) are at risk of impaired skin integrity because their skin is dry and more susceptible to cracking. Patients who work with chemicals are also at risk of impaired skin integrity and should use appropriate personal protective equipment when working with those substances. Lotions with sunscreen protection factor (SPF) should be used and protective clothing worn when spending time in the sun. Not taking these precautions increases the risk of sunburns, premature aging of the skin, wrinkles, and skin discoloration.

State of Health and Genetic Factors

State of health and genetic factors may affect the skin. Nutrition can adversely or positively affect the health of the skin. Some people experience dehydration and malnourishment caused by an illness versus a lifestyle choice. Dehydration and malnourishment result in a deficiency in fluids, protein, and vitamin C. This causes the skin to lose its elasticity and become more susceptible to breakdown.

Patients with impaired sensation (e.g., paralysis, poor circulation, nerve damage) are at risk of impaired skin integrity caused by the inability to sense pressure, friction, pain, or extreme temperatures. For example, a patient with diabetic neuropathy may not be able to feel the ice pack on their foot after surgery. If the patient were to forget it was there, they could experience frostbite or other skin injury because of the inability to feel any damage being caused. Patients who have diabetes are prone to skin problems caused by alterations in vascular, immune, neuropathic, and biochemical components. These components impair tissue oxygenation and decrease uptake of essential nutrients needed to maintain skin integrity. People with diabetes may also experience delayed wound healing, lesions that turn into ulcers and become necrotic, and recurrent infections.

Side effects of certain medications may also affect skin. For example, localized pruritus (or itching) is common with hydrocodone, and patients may scratch themselves in an attempt to relieve the itching. Corticosteroids cause thinning of the skin, making it more susceptible to injury, and certain antibiotics increase sensitivity to sunlight

causing an individual to burn easily. Patients who experience incontinence or have issues with diarrhea are at risk of skin breakdown as a result of the excess moisture. Patients with jaundice are at risk of lesions and infections from scratching because of dry, itchy skin. There are also numerous conditions that cause secondary disruptions to the integumentary system. For example, patients undergoing radiation treatment for cancer are at risk of **erythema** (a reddening of the skin), pruritus, or loss of skin integrity (Figure 21.8).

FIGURE 21.8 Erythema (a reddening of the skin) has multiple causes—in this case, heat rash. (credit: "16850" by CDC/Dr. Lester Cordes, Public Domain)

Numerous skin conditions may have a genetic component and may be inherited (e.g., **vitiligo**, acne, melanoma, psoriasis, eczema). Vitiligo has a polygenic inheritance pattern, meaning that multiple alleles contribute to the genetic component of the disease. Fifteen acne-related genetic variants may influence the shape of hair follicles, which may make them more susceptible to bacterial inflammation. Melanoma has been known to occur in several members of the same family. These familial cases may be caused by inheriting several genes associated with melanoma that increase the risk of developing melanoma. Psoriasis and eczema have a genetic predisposition component and often cause skin lesions. They also may be caused by inflammation resulting from eating certain products (e.g., gluten, dairy).

Common Skin Disorders

There are various skin disorders that the nurse should be aware of to effectively care for their patients. Common skin disorder classifications include bacterial infections, viral infections, fungal infections, inflammatory reactions, and skin cancers. It is crucial for the nurse to be able to identify and describe skin disorders as well as their underlying causes and treatments.

Bacterial Infections

Bacteria naturally reside on the skin. An infection can occur, however, when the skin is not intact, allowing bacteria to enter through hair follicles or breaks in the skin (e.g., scrapes, surgical incisions, bites). Some bacterial infections are localized and involve just the skin, the soft tissues under the skin, or they can become systemic involving multiple body systems. Common bacterial infections of the skin include impetigo, folliculitis, carbuncles, and cellulitis (Table 21.1).

Disorder	Description	Example
Impetigo	Contagious superficial skin infection	(credit: modification of work from *Microbiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Folliculitis	Infection of the hair follicle	(credit: modification of work "Folliculitis post shaving SV1.jpg" by Dr. Shyam Verma, MBBS, DVD, FRCP, FAAD/Wikimedia Commons, CC BY 4.0)
Carbuncle	Clusters of deep skin abscesses	(credit: modification of work "MRSA Bacteria Photo 3" by Public Health Image Library (PHIL), Public Domain)
Cellulitis	Localized infection and inflammation	(credit: "Cellulitis toes (44699139982).jpg" by John Campbell/Wikimedia Commons, Public Domain)

TABLE 21.1 Common Bacterial Skin Disorders

Impetigo

Most commonly found in children, **impetigo** is a highly contagious superficial skin infection. Patients with impetigo can spread it to other areas of their own body as well as to other people they come in contact with. Although it can occur anywhere on the body, it primarily occurs on the arms, legs, and face. Impetigo is either bullous or nonbullous in nature. Usually sporadic, **bullous impetigo** develops on intact skin and is caused by *Staphylococcus aureus*. Flaccid bullae generally grow in size to form larger blisters filled with clear yellow to dark turbid fluid and burst to expose raw skin that becomes covered with a thin brown crust. The most common kind of impetigo is **nonbullous impetigo** that usually occurs after injury to the skin or as a secondary bacterial infection of another skin disorder like atopic dermatitis. Nonbullous impetigo presents as clusters of pustules that rapidly break down and form thick, adherent, honey-colored crusts on the face and extremities. Other risk factors for impetigo include poor hygiene and a moist environment. Treatment for impetigo may include topical or oral antibiotics.

Often called deep impetigo, **ecthyma** is a skin infection that occurs deep inside the skin characterized by shallow, small ulcers that look punched-out and may contain pus. The brown crust that covers the ulcers is thicker than the crust that covers the ulcers of impetigo. Treatment options for impetigo and ecthyma include antibiotic ointments or creams for smaller areas. Larger infected areas or areas that are not responding to the topical antibiotics may require oral antibiotics. The infected areas should be washed gently with soap and water multiple times a day to remove crusts. Individuals who have recurrent infections should have a nasal swab cultured to see if they are a nasal carrier of *Staphylococcus* or *Streptococcus*. People who are nasal carriers will need a topical antibiotic applied to their nasal passages (Rehmus, 2023).

Folliculitis

An infection of the hair follicle that often results from occluded hair follicles is termed **folliculitis**. It may affect a single hair follicle or multiple hair follicles. Common risk factors for folliculitis include poor hygiene, **maceration** (occurs when skin is exposed to a moist environment for too long), occlusive emollient products, and contact with contaminated water. Folliculitis often appears as pustules surrounded by erythema where a hair follicle is present. Hair follicles may easily fall out as well. Treatment includes warm compresses after washing with antibacterial soap and water multiple times a day, topical antibiotics, and oral antibiotics.

Carbuncle

A **carbuncle** is a skin abscess that connects with other carbuncles below the surface of the skin to form clusters, often forming when one or more hair follicles become infected. If left untreated, the abscesses fill with pus and will rupture, discharging a creamy pink or white fluid. If the abscess is too deep, it may not be able to drain on its own. Bacteria can spread from the abscess and infect surrounding tissues and lymph nodes. Infected individuals may also have a fever, chills, and malaise. Carbuncles are likely to leave a scar. Most carbuncles are caused by *Staphylococcus aureus*. Risk factors for the development of carbuncles include poor overall health, friction from shaving or clothing, and poor hygiene. Patients with weakened immune systems are more likely to develop *Staphylococcus* infections that lead to carbuncles. Some skin abscesses may go away on their own with the use of warm compresses. However, some carbuncles may require a provider to open and drain the abscess and then wash out the pocket with a sterile saline solution. Oral antibiotics may also be needed to aid in treating the infection. Individuals with recurrent skin abscesses may be instructed to wash their skin with antiseptic solutions (e.g., iodine) (Rehmus, 2023).

Cellulitis

A localized infection and inflammation of the skin and tissues beneath the skin is called **cellulitis**. It is most often caused by *Streptococcus*, *Staphylococcus*, and *Methicillin-resistant Staphylococcus aureus.* The infection usually occurs when the bacteria enters open wounds, skin abscesses, fungal infections, or other skin conditions. Although cellulitis can occur anywhere on the body, it occurs most often on the legs and affects one side of the body. Bilateral cellulitis is rare, and its presence should warrant assessment of other health conditions (Chuang et al., 2022).

The infection generally presents with redness, tenderness, and pain. The skin also often becomes hot and swollen and may look slightly pitted. A fluid-filled **vesicle** (small blister) or a **bulla** (large blister) may appear on the infected areas. Some patients may experience fever, rapid heart rate, headache, confusion, hypotension, or chills. If the infection spreads to the lymph nodes, the nodes can become tender and swollen, and the vessels can become inflamed. Treatment may include antibiotics, drainage of any abscesses, and treatment of any disorders contributing

to the infection (Rehmus, 2023). Compression stockings (thromboembolic deterrent [TED] hose) may also be effective by reducing edema (swelling caused by excessive buildup of fluid in tissue spaces or a body cavity) and increasing blood flow.

LINK TO LEARNING

Information regarding the therapeutic benefits of compression stockings (https://openstax.org/r/77compressionsock) is presented by Wound Care Centers. Compression stockings help reduce edema and increase blood flow back to the heart.

Viral Infections

Viral skin infections are the result of a reaction from a systemic virus within the body or an infection of the skin itself. This type of infection encompasses a variety of conditions such as herpes simplex, herpes zoster, verruca, and human papillomavirus (Table 21.2). Viral skin infections are often contagious, and some may be passed by skin-to-skin contact or through the air when the infected individual coughs or sneezes.

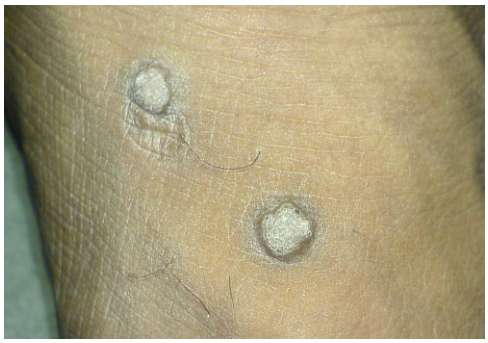
Disorder	Description	Example
Herpes simplex	Infection caused by herpes simplex virus type 1 (HSV-1) and HSV-2	(credit: "Vesicular rash on lower legs" by Justice, E.A., Khan, S.Y., Logan, S. et al./Journal of Medical Case Reports, CC BY 2.0)
Shingles	Rash associated with varicella-zoster virus	(credit: modification of work "21506" by CDC/K.L. Herrmann, Public Domain)
Verruca	Growths on the skin caused by human papillomavirus	 (credit: modification of work "Verruca vulgaris.jpg" by "Abbassyma"/Wikimedia Commons, Public Domain)

TABLE 21.2 **Common Viral Skin Disorders**

Herpes Simplex

A viral infection that can cause painful blisters or ulcers is **herpes simplex** and is categorized into herpes simplex virus type 1 (HSV-1) and herpes simplex virus type 2 (HSV-2). Most often, HSV-1 spreads by oral contact and causes infections in or around the mouth or lips. This virus presents as ulcers or blisters (cold sores). It can also cause genital herpes if an infected person made contact with another person's genital mucosa. HSV-1 is commonly spread through kissing, sharing objects that are in or near the mouth, and any other skin-to-skin contact. On the other hand, HSV-2 is spread by sexual contact and causes genital herpes. This virus usually presents as open sores, blisters, or bumps around the anus or genitals. It may also appear in the sacral area. Someone who has an active outbreak and is giving birth can also pass the virus to the baby.

It is not uncommon for patients with herpes infections to have little to no symptoms; therefore, an infected individual may unknowingly spread the virus. The first outbreak may be accompanied by body aches, swollen lymph nodes, and fever. Subsequent outbreaks may begin with burning, itching, or tingling prior to the appearance of blisters. The blisters often appear in clusters and break open, ooze, and crust over. Outbreaks can be caused by triggers like stress, fever, illness, surgery, menstrual periods, and sun exposure. This virus can be recurring and is not curable. Antiviral medications (e.g., valacyclovir [Valtrex] and acyclovir [Zovirax]) may be used to shorten the length and severity of the herpes simplex breakout. Some patients may take the medications daily to prevent outbreaks and lessen the chance of spreading it to others. Other treatment options include minimizing triggers, topical anesthetics, topical ointments, or over-the-counter pain medications like acetaminophen (Tylenol) or ibuprofen (Motrin). Patients with genital herpes may decrease symptoms by wearing loose clothing and sitting in a warm bath without soap. Cold drinks or popsicles may also aid in providing relief to those with oral cold sores. Patients should also be educated on the importance of informing any potential sexual partners and abstaining from sexual activity when lesions are present, replacing toothbrushes or lip balms used during the presence of a cold sore, and not sharing utensils or drinks with uninfected people (World Health Organization, 2023).

Herpes Zoster

The **varicella** (chickenpox) infection is caused by the varicella-zoster virus. After the initial illness has ended, the virus remains dormant in the dorsal root ganglia and can reactivate later in the person's life causing a painful, maculopapular rash called **herpes zoster** (shingles). Patients who have received a varicella vaccine are also at risk of developing herpes zoster later. The rash associated with shingles most often appears on the trunk of the body along a thoracic dermatome. The rash primarily stays on one side of the body, follows dermatomes, and does not cross the midline. Although not common, the rash can affect three or more dermatomes and is called **disseminated zoster**. This type of rash occurs in patients with a weakened or suppressed immune system. The symptoms are often painful, tingly, or itchy and may precede the appearance of the rash. Some patients may also experience headache, malaise (overall weakness) in the **prodromal** state (period between the appearance of initial symptoms and the full development of an illness), chills, or photophobia (bright light sensitivity). Vesicles develop into clusters, which continue to form over three to five days and gradually dry and crust over. The rash usually heals in two to four weeks and can leave scarring or pigmentation changes behind. Shingles can be prevented by the recombinant zoster vaccine. This virus can spread to others when it is active and can cause varicella in those who have never had varicella or been vaccinated against it. Antiviral medications, like valacyclovir and acyclovir, may also be used to shorten the length and severity of a shingles breakout (Centers for Disease Control and Prevention, n.d.).

Verruca

A growth on the skin caused by the viral infection human papillomavirus (HPV) is called a **verruca** or a wart. The warts may appear raised or flat and can have a black dot in the middle. Warts are often not painful, although some people may complain of pain. Warts may develop at any age but are more commonly found in children. Patients with warts may have as few as one or as many as hundreds. Warts are contagious and can spread from one area of the patient's body to another body part or to another person through prolonged or repeated contact. Only a small break in the skin needs to be present for the virus to spread (Dinulos, 2023c). Genital warts, however, are spread by sexual contact.

Verrucae are classified by their shape and location. A warts that grows in clusters is referred to as a **mosaic wart**. Common warts are firm, round, or irregularly shaped growths with a rough surface. They may be brown, yellow, gray-black, or light gray and are generally less than 1 centimeter across. These warts appear on the face, fingers, elbows, and knees. A wart on the soles of the feet is a **plantar wart** and is usually flat due to the pressure of standing and walking. Warts that appear on the soles of the feet may cause pain when walking or standing. A wart found on the palms of the hand is a **palmar wart**. Both palmar and plantar warts tend to be hard and flat with well-defined boundaries and a rough surface. Thick, cauliflower-like growths around the fingers are known as periungual warts. A long, small, narrow growth that appears on the lips, face, or eyelids is a **filiform wart**. A warts that may appear in areas that are shaved or along stretch marks is a **flat wart**. They are typically smooth, flat topped, and either yellow-brown, pink, or flesh colored. A warts that occurs on the vagina, vulva, cervix, and penis is a **genital wart** (condyloma acuminata, venereal warts). This type of wart can be flat, smooth, and irregular or velvety bumpy growths with a cauliflower-like texture (Dinulos, 2023c).

Generally, warts are easily recognizable by appearance. Occasionally, a biopsy may be needed to confirm the

diagnosis. Treatment options include applying topical chemicals and burning, cutting, or freezing the wart. A candidal yeast antigen may be injected into the warts causing an immune response to fight against the virus (Dinulos, 2023c). Warts may return even after removal. The human papillomavirus (HPV) vaccine may be used to prevent the spread of the virus. Patients with genital warts should have the warts removed to prevent spreading from person to person. They should also be educated on safe sex and the need to inform their partners of the diagnosis.

Fungal Infections

Fungal skin infections caused by fungus overgrowth most commonly occur in moist areas of the skin like between the toes, under breasts, or in the genital areas. Fungal skin infections are usually caused by yeasts (e.g., *Candida albicans*) or dermatophytes (e.g., *Microsporum)*. The fungi live on the stratum corneum and typically do not penetrate deeper into the skin. Patients with a higher weight are more likely to have fungal skin infections related to excessive skinfolds. Patients with diabetes are also at risk of fungal infections (Aaron, 2023). Common fungal skin infections include six types of tinea (Table 21.3).

Disorder	Description	Example
Tinea pedis	Also known as athlete's foot; fungal infection characterized by a buildup of scale and may be accompanied by redness and itching	(credit: "Athletes foot.JPG" by "Ellington"/Wikipedia, Public Domain)
Tinea barbae	Also known as beard ringworm; generally a superficial infection but may occur deeper	(credit: modification of work "4807" by CDC/Public Health Image Library (PHIL), Public Domain)

TABLE 21.3 Common Fungal Skin Disorders

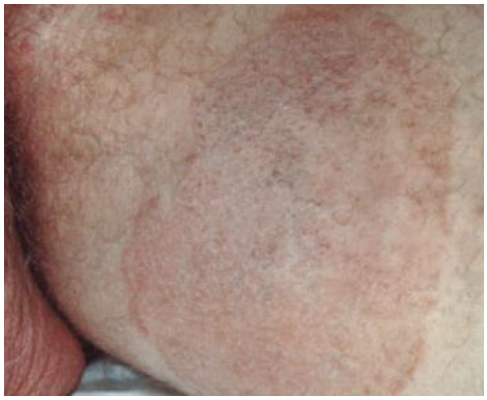
Disorder	Description	Example
Tinea corporis	Also known as body ringworm; a fungal skin infection affecting the face, arms, trunk, and legs	(credit: modification of work "Tinea corporis.jpg" by "Mohammad3021"/Wikimedia Commons, Public Domain)
Tinea cruris	Also known as jock itch; a fungal skin infection of the groin	 (credit: modification of work "21482" by CDC/ Dr. Lucille K. Georg/Public Health Image Library (PHIL), Public Domain)

TABLE 21.3 Common Fungal Skin Disorders

Disorder	Description	Example
Tinea capitis	Also known as scalp ringworm; a fungal infection of the scalp	(credit: modification of work "Fig 2. Tinea capitis clinical presentation." by Coulibaly O, Kone AK, Niaré-Doumbo S, Goïta S, Gaudart J, Djimdé AA, et al./PLoS Neglected Tropical Diseases, CC BY 4.0)
Tinea unguium	Also known as onychomycosis; a fungal infection of the toenail or fingernail	(credit: "579" by CDC/ Dr. Edwin P. Ewing, Jr./Public Health Image Library (PHIL), Public Domain)

TABLE 21.3 Common Fungal Skin Disorders

Tinea

Also known as ringworm, **tinea** may be found on the feet, beard, body, groin, scalp, or toes. The condition **tinea pedis** (or athlete's foot) is characterized by a buildup of scale and may be accompanied by redness and itching. This infection is commonly caused by sweat from the feet accumulating between the toes allowing fungi to grow. This infection can spread to others who share showers, bathrooms, or other areas where infected individuals walk barefoot. Patients who wear tight shoes are also at risk of developing this infection. Fluid-filled blisters may also form with this infection. If the scaling is severe, the skin may crack and can lead to bacterial infections. Athlete's foot may be treated by topical antifungal ointments or oral antifungals like itraconazole (Sporanox). Prevention measures include wearing sandals or shower shoes in communal bathrooms, wearing breathable shoes, frequently changing socks, minimizing moisture on feet and in footwear, and completely drying feet and in between toes after bathing. Antifungal powders may also be used to aid in keeping the feet dry (Aaron, 2023).

A **tinea barbae** (beard ringworm) infection is generally superficial but may occur deeper into the dermis. Tinea barbae is characterized by circular patches or a swollen patch that may ooze pus and can result in scarring or whisker loss. Most beard skin infections are caused by bacteria rather than fungi; however, tinea barbae is a fungal infection. Antifungal medications or corticosteroids are common treatments for beard ringworm (Aaron, 2023).

The fungal skin infection **tinea corporis** (body ringworm) affects the face, arms, trunk, and legs. This infection is characterized by round, pink-to-red patches with raised, scaly borders that can be itchy. Clearing in the center may also be present. This infection can spread from one area of an infected person's body to another or from person-to-person contact. Antifungal medications may be applied topically or taken orally to treat this infection (Aaron, 2023).

A **tinea cruris** (jock itch) infection is a fungal skin infection of the groin. This is often characterized by a painful, itchy rash with a scaly, pink border. This infection is more common in men and is caused by trapped moisture between the scrotum and thigh and most often develops in warm weather or when wearing tight or wet clothing. Patients of a higher weight are at risk as well because of trapped moisture in skinfolds. The infection usually begins in the skinfolds of the genital area and spreads to the upper inner thighs. Antifungal medications may be taken orally or applied topically (Aaron, 2023).

The fungal infection **tinea capitis** (scalp ringworm) occurs on the scalp. This infection is characterized by a scaly, dry patch, a patch of hair loss, or both. The hair shafts may break at the surface (black dot ringworm) or break above the surface (gray patch ringworm). This infection can also cause dandruff-like flaking. A kerion may also be present. A kerion is a large, inflamed, swollen and sometimes painful patch that can ooze pus. A culture may be needed to assess the type of fungus, or a UV light may be used to confirm the diagnosis. Treatment of scalp ringworm includes oral antifungals, antifungal creams, selenium sulfide (Selsun Blue) shampoos, or corticosteroids (Aaron, 2023).

The fungal infection **tinea unguium** involves the toenail or fingernail. This infection is characterized by thickened nails that crumble easily and have white or yellow discoloration. The whole nail may become detached in more severe infections. If left untreated, the patient may have pain, balance issues, or a candidal infection. Treatment options include oral antifungals, topical ciclopirox olamine (Penlac) nail lacquer, and topical antifungals. Prevention is similar to that of preventing athlete's foot.

Parasitic Infections

A parasite is an organism that lives in or on an organism of a different species (the host) and depends on the host for nutrients. Parasitic skin infections occur when insects or worms burrow into the skin of a patient to lay their eggs or live there. Common parasitic skin infections include scabies and pediculosis (lice) (Table 21.4). Both infections are spread from person to person through physical contact. The parasites can live on physical objects such as brushes, clothing, furniture, and bedding; therefore, the parasites can spread to another person as well when contact is made with infested objects. Parasitic infections are generally treated by removing the source of the infestation as well as using topical and oral medications to aid in killing the parasites and to relieve any swelling, itching, or skin damage (Campbell & Soman-Faulkner, 2023).

Disorder	Description	Example
Scabies	Mites	(credit: "ScabiesD03.jpg" by "Cixia"/Wikipedia, Public Domain)
Pediculosis capitis	Head lice	(credit: "Figure 4. Heavily infested hair with Pediculus humanus capitis (arrow)" by Genevieve Milon/PLoS Neglected Tropical Diseases, CC BY)
Pediculosis corporis	Body lice	(credit: modification of work "Figure 1. Nuisance related to lice" by Abdoul Karim Sangaré, Ogobara K. Doumbo, Didier Raoult/BioMed Research International, CC BY)

TABLE 21.4 Common Parasitic Skin Disorders

Scabies

The *Sarcoptes scabiei* mite causes **scabies**. Scabies are accompanied by extreme itching, no matter how few mites have burrowed into the skin. Initially, the burrows are often visible and can be anywhere on the body, except they are less likely on the face. The burrows appear as a thin line and can have a tiny bump where the mite is located. Darker-skinned individuals may only display raised, solid areas. Due to the intense scratching, this infestation can often turn into a bacterial infection. Over time, the areas usually become inflamed, making the burrows less visible.

Infestations that turn severe may cause areas of crusted, thickened skin that do not itch. Risk factors for attracting scabies are crowded conditions like schools, multifamily homes, and shelters. Hygiene is not a factor with scabies.

Treatment for scabies includes applying topical permethrin (Acticin) creams or lindane (Lindane) lotions to the skin for several hours before washing off. Lindane lotion is contraindicated in children under the age of 2 years, patients with a seizure disorder, and pregnant or breastfeeding patients. For older children and adult patients, spinosad suspension (Natroba) may be applied to the skin avoiding the eye. Ivermectin (Stromectol) may also be taken orally for people who have not had therapeutic benefits from topical medications or cannot use them. Itching can be relieved by oral and topical antihistamines. Infestations that progress to a bacterial infection may also require antibiotics. Physical objects that have come in contact with an infested patient should be washed in hot water, thoroughly dried on high heat, and stored in a sealed plastic bag for three days. Individuals who have close contact with a patient experiencing an infestation should also be treated (Dinulos, 2023a).

Pediculosis

A lice infestation is **pediculosis**. Lice are wingless insects that are not easily seen and may infect the body, head, or pubic area. Each type of lice can cause severe itching and bites that range from red (body and head lice) to grayish blue (pubic lice). An infestation with lice may be diagnosed with the presence of lice, nits (or eggs), or both. A fine-tooth comb may be needed to assess the hair for lice, and the nits may be easier to see versus the lice itself. Body lice are often found in the seams of clothing and bedding. Pubic lice may require a UV light or a microscope to be seen. Pubic lice may leave feces on the patient's skin or underwear, which are characterized by dark brown specks. An infestation with lice will require replacing or thoroughly cleaning and drying linens and clothing. Items that are not able to be laundered can be placed in an airtight bag for two weeks to kill the lice. People who have close contact with an infected patient should also treat themselves, including sexual partners (Dinulos, 2023b).

Body lice (**pediculosis corporis**) live on and lay their eggs on bedding and clothing rather than the skin. The lice will migrate to various areas of the body to feed. Patients who live in crowded areas, have poor hygiene, or are of low socioeconomic status are more at risk of acquiring body lice. The lice spread because of sharing contaminated bedding and clothing. This type of lice can also transmit different types of fevers (Dinulos, 2023b). Treatment includes thoroughly cleaning linens and clothing.

Head lice (**pediculosis capitis**) are found on the hair and scalp. The lice lay eggs that take about one week to hatch and are called nymphs. It takes another seven days for the nymphs to reach their adult stage. The lice require a blood supply to live and will feed off their host several times a day. If the lice are deprived of blood, they will usually die within one to two days. Hygiene and socioeconomic status have no bearing on head lice. Shampoos that contain permethrin (Acticin), piperonyl butoxide (Red Pediculicide), or lindane (Lindane) are effective for treating head lice. Creams that contain malathion (Ovide) or spinosad (Natroba) suspensions may also be effective. Nits need to be removed with a fine-tooth comb. Treatments must be repeated seven to ten days later to kill any potential newly hatched lice. Ivermectin (Stromectol) may also be used if lice are resistant to medicated shampoos or creams (Dinulos, 2023b).

Pubic lice (**pediculosis pubis**), often referred to as crabs, infest the hairs of the anal and genital areas but can also infest the thigh, chest, and facial hair. This type of lice may be spread by sexual contact or close contact or by physical objects like linens and clothing. The same shampoos and creams used for head lice are effective for treating pubic lice. In addition, petroleum jelly, physostigmine ointment, fluorescein eye drops, petrolatum salve, and oral ivermectin (Stromectol) are effective for the lice that have infested a patient's eyelashes (Dinulos, 2023b).

Inflammatory Reactions

Inflammatory skin reactions are either chronic or acute and are the result of a hypersensitivity reaction, an autoimmune disorder, or a genetic predisposition. These skin reactions may also recur when the stress factors or environmental triggers that caused the reaction are present. Inflammatory skin reactions include eczema, seborrheic dermatitis, urticaria, acne vulgaris, psoriasis, and systemic lupus erythematosus (SLE) (Table 21.5). These reactions require obtaining a comprehensive health history including family history, medications, diet, hygiene practices, and environmental conditions as well as a full assessment to identify possible triggers or causes.

Disorder	Description	Example
Eczema	Itchy, chronic inflammation of the skin	(credit: "Eczema-arms.jpg" by "Jambula"/Wikimedia Commons, Public Domain)
Seborrheic dermatitis	Inflammatory skin reaction primarily on the scalp and face	(credit: modification of work "Seborrhoeic dermatitis2.jpg" by Klaus D. Peter/Wikimedia Commons, CC BY 3.0)
Urticaria	Rash characterized by wheals and erythema	(credit: modification of work "Urticaria2.JPG" by "Hyper84"/Wikimedia Commons, Public Domain)

TABLE 21.5 Common Inflammatory Skin Disorders

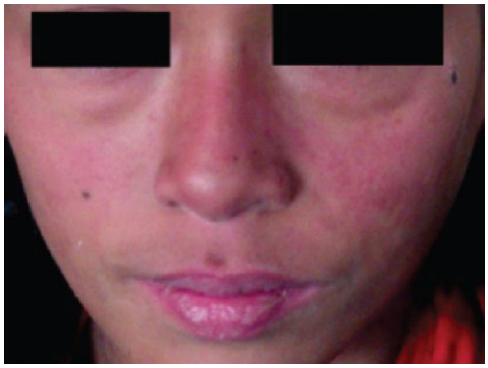
Disorder	Description	Example
Acne vulgaris	Inflammatory skin reaction caused by clogged hair follicles	(credit: modification of work "Acne papulopustulosa, Decolleté" by Dr. Thomas Brinkmeier/Wikimedia Commons, CC BY 4.0)
Psoriasis	Recurring, chronic condition that causes red patches with silvery scales	(credit: "Psoriasis on elbow.jpg" by Haley Otman/Wikimedia Commons, CC BY 3.0)
Systemic lupus erythematosus	Chronic, autoimmune inflammatory disorder, often presents with a butterfly rash	 credit: modification of work from *Microbiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

TABLE 21.5 Common Inflammatory Skin Disorders

Eczema

The condition **eczema** (atopic dermatitis) is a part of the atopy family. Atopy means there is a genetic tendency to develop allergic conditions like asthma, eczema, and allergic rhinitis and is associated with a heightened immune response. This rash is characterized by itchy, chronic inflammation of the outer skin layers. In the acute phase, the rash may appear as red, oozing, and crusted areas with occasional blisters present. The chronic phase may have dry, thickened areas caused by scratching and rubbing. The rash may occur in one or more areas in adult patients and can spread to several areas on infants. The rash can vary in intensity, color, and location but is always itchy and triggers scratching, which can cause the skin to break and bleed. Stress, irritation, and dry air also make the itching more intense. Environmental triggers include harsh soaps, excessive bathing or handwashing, sweating, rough fabrics (e.g., wool), or *Staphylococcus aureus* present on the skin. Allergens like wheat, dairy, and eggs may also be

a trigger. Tears in the skin caused by scratching or rubbing can often lead to bacterial infections.

Prevention includes minimizing triggers and managing stress. Treatments include skin care, UV light, corticosteroids, and biologic agents. General skin hygiene includes using soap substitutes, applying moisturizers after bathing, using lukewarm water, and patting skin dry. Antihistamines may also be used to relieve itching. Antibiotics may be needed when the reactions escalate to bacterial infections or for patients who are at risk of developing an infection (Ruenger, 2023). This reaction can be disabling and have long-term emotional effects that may require additional assessment and interventions to promote positive coping and body image.

Seborrheic Dermatitis

The inflammatory skin reaction **seborrheic dermatitis** affects the scalp and may also be present on the face, around the ears, and occasionally on other areas that have oil glands present. This reaction is more common in infants and adult patients from 30 to 70 years of age. Genetic factors and cold-weather conditions affect the severity and risk of this disorder. The rash is characterized by greasy, yellow scales, pruritus, and dandruff.

Seborrheic dermatitis is triggered by yeast, stress, hormonal changes, harsh detergents or soaps, dry or cold weather, certain medical conditions (e.g., HIV, Parkinson disease), and certain medications (e.g., psoralens [Uvadex] and lithium [Lithobid]). Patients with darker skin may have a darker-colored rash and have lesions around the hairline with possible skin discoloration. Treatments include application of antifungal creams (efinaconazole [Jublia]); corticosteroid creams or solutions (clocortolone pivalate [Cloderm]); calcineurin inhibitors (tacrolimus [Prograf]); antifungal shampoos; and shampoos containing zinc pyrithione (DermaZinc), selenium sulfide (Selsun Blue), and salicylic acid (Baker P&S). Treatment for infants differs by washing with a mild shampoo and applying hydrocortisone cream or fluocinolone oil on the face or into the scalp. Antifungal creams may also be used. Treatment for young children includes using mineral oil, corticosteroid gel, or olive oil to the affected areas (Ruenger, 2023). Treatment often requires repeating until the seborrheic dermatitis is resolved and can be restarted if it returns.

Urticaria

The type I hypersensitivity reaction **urticaria** (or hives) results from an immunologically mediated antigen-antibody response of mast cells releasing histamine. This reaction is characterized by wheals (or hives) and erythema present after vasodilation and increased vascular permeability. The rash is easily identifiable by a raised, swollen, flesh-colored or red bumps or welts on the skin. This reaction often begins rapidly and may be accompanied by swelling of the face, lips, throat, or airways (**angioedema**). The wheals can take several weeks to resolve.

The most common triggers include medications, foods, infections, stress, insect bites, and environmental stimuli (e.g., sun, light clothing, sun, heat, cold). Any of the triggers can cause a reaction if injected, inhaled, consumed, or touched. Autoimmune conditions can also trigger urticaria. Any potential or identified trigger must be stopped and removed immediately. Reactions of this type that do not have appropriate intervention may lead to respiratory distress. The airway and breathing must be assessed with this type of reaction, and appropriate intervention must be started immediately if needed. Treatment options also include antihistamines, steroids, or topical antipruritic agents. Epinephrine may also be used for serious reactions. Any identified triggers must be included as part of the patient's health history. The patient and family should be educated to report this as a reaction to a food, medication, or other environmental trigger, and a medical alert bracelet may also be needed (Ricci et al., 2016).

Acne Vulgaris

Acne is a common inflammatory skin reaction causing pimples, papules, pustules, blackheads, whiteheads, cysts, or abscesses on various areas of the skin. These skin abnormalities vary in size, severity, and deepness into the skin layers. The common skin condition **acne vulgaris** is caused by bacteria, dead skin cells, or dried sebum that clogs hair follicles and prevents sebum from passing up through the pores (Figure 21.9). Acne triggers include puberty, polycystic ovarian syndrome, pregnancy, menstruation, hormonal disturbances, tight clothing, humidity, sweating, certain medications (e.g., anabolic steroids, corticosteroids), or various skin products (e.g., lotions, makeups, soaps). Identifying triggers can be difficult and may require making small changes at a time to determine the specific cause.

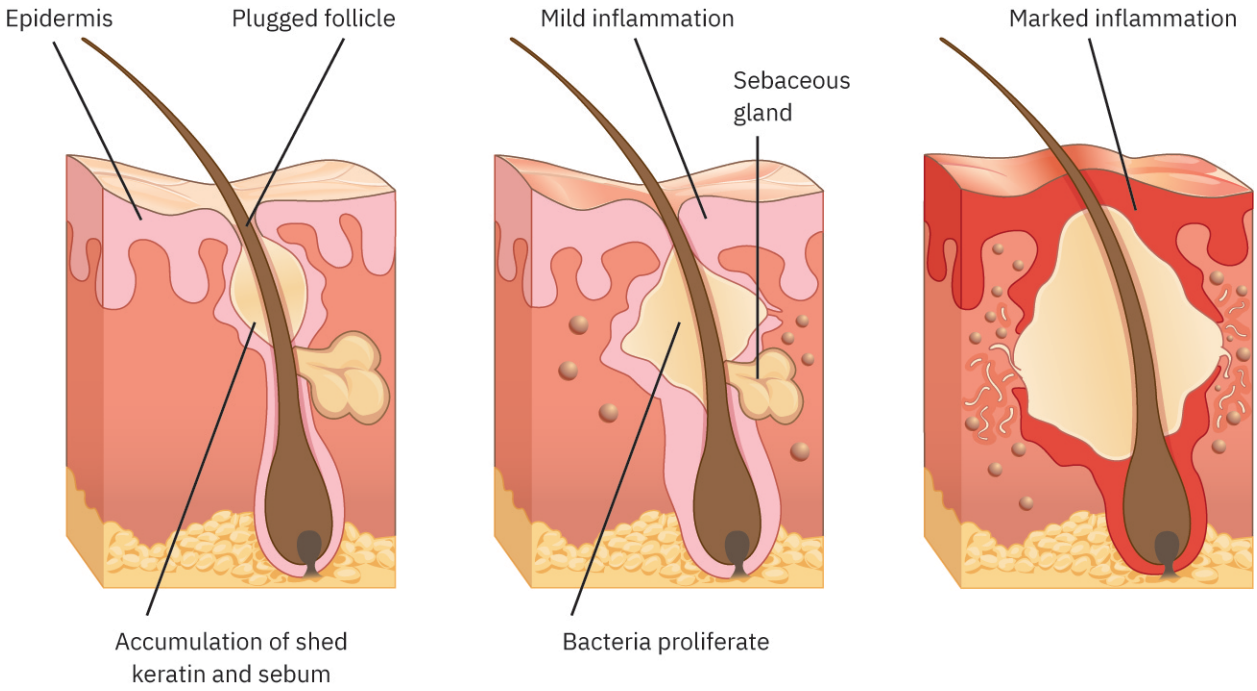


FIGURE 21.9 There are several types of acne. The most common types are whiteheads, blackheads, pustules, papules, cystic acne, and nodules. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Mild acne includes blackheads, whiteheads, pimples, papules, and pustules and generally does not leave scars unless skin injury occurs when popping or squeezing the pimples. A flesh-colored, small bump with a dark center is a **blackhead**. A flesh-colored small bump that does not have a dark center is a **whitehead**. A **pimple** has a small area of red skin and can be painful or cause discomfort. A **pustule** is similar to a pimple but contains white or yellow pus. Severe acne is when patients have several blackheads, whiteheads, pimples, pustules, nodules, or deep acne (cystic acne). The **cystic acne** lesions are usually larger, red, painful, and pus-filled nodules that merge under the skin and often leave scars.

Acne generally lessens in severity by the midtwenties but may appear to those in their forties. This type of skin reaction can cause emotional stress and may require counseling. General care for acne includes washing daily with a mild soap, using water-based cosmetics, and eating a balanced diet low in processed carbohydrates. Inflammatory foods like gluten or dairy may need to be limited because they can cause acne for some individuals. Blackheads and whiteheads can be removed by **comedone extraction**. This is the use of a comedone extractor by a healthcare professional to incise the pore and then use gentle pressure around the pore opening with a wire loop.

There are also strips available at most pharmacies or grocery retailers for at-home extractions. Other treatment options include tretinoin cream (Retin-A), benzoyl peroxide (Acne-Clear), or antibiotics for blackheads, whiteheads, pimples, and pustules. Isotretinoin (Absorica) is effective for severe acne, and corticosteroids are effective for cystic acne. Other medications like oral contraceptives, spironolactone (Aldactone), and clascoterone (Winlevi) may also be used for hormonal acne. Acne scarring may be treated with a laser, microneedling, dermabrasion, collagen injections, or chemical peels (Keri, 2024).

Psoriasis

The recurring, chronic skin condition **psoriasis** causes one or more raised areas of red skin patches with silvery scales and a distinct border. Psoriasis is caused by an abnormally high rate of skin cell growth. This skin condition is immune mediated and often occurs because of a genetic predisposition. It can occur anywhere on the body. Various triggers may exacerbate this skin condition, but it is controllable. Flare-ups of psoriasis may be triggered by burns, colds or infections, stress, certain medications, cold weather, obesity, HIV, smoking, and inflammatory foods like gluten. Therapeutic management includes coal tar topical (Balnetar) shampoos, UV light, topical steroids, mineral oil, topical anti-inflammatories, emollient creams, immunosuppressants (e.g., methotrexate [Trexall]), and other medications (e.g., acitretin [Soriatane] and infliximab [Avsola]). Patients who have identifiable triggers may need to engage in lifestyle modifications, such as limiting cold exposure or eliminating inflammatory foods, such as sugar

and high-fructose syrups (Das, 2023).

Systemic Lupus Erythematosus

The chronic autoimmune inflammatory disorder **systemic lupus erythematosus (SLE)** involves connective tissues of the joints, skin, kidneys, mucous membranes, and blood vessel walls. This skin disorder, also known as lupus, can be diagnosed with blood tests or other diagnostic testing. Sudden fever is often the first symptom of this condition. The rash is characterized by round, raised, and reddened areas that can lead to skin loss, scarring, and hair loss. This skin disorder may also include a butterfly-shaped reddened area across the nose and cheeks. Light-exposed areas (e.g., face, scalp) also have clusters of the rash. The rash may be flat or have psoriasis-like characteristics, and those affected may experience painful joints and fatigue. Migraines, mental disorders, epilepsy, and organ dysfunction may also occur. Patients with SLE may experience lung problems (e.g., pleural effusion), heart problems (e.g., pericarditis), enlarged lymph nodes or spleen, kidney failure, decreased blood cells or platelets, gastrointestinal problems (e.g., nausea, pancreatitis), or pregnancy complications (e.g., miscarriage, stillbirth) (Nevares, 2022). People with SLE often also experience **Raynaud phenomenon**, a condition that causes pale or blue fingers with cold exposure.

Flare-ups of lupus may be triggered by infection, pregnancy, surgery, or sun exposure. Early detection is optimal for a better prognosis and limiting the risks of kidney and other organ damage. Treatment options include hydroxychloroquine (Quineprox), nonsteroid anti-inflammatory drugs, corticosteroid creams, oral corticosteroids, and antimalarial or immunosuppressive medications. People who experience damage to other organs may require a transplant or dialysis, blood clots may need anticoagulants like warfarin (Coumadin), or complications of long-term steroid use may need vitamin D and calcium supplements to aid in preventing osteoporosis. People who have SLE should be closely monitored for diabetes and heart or kidney disease and should be educated on signs and symptoms. Pregnant women with SLE should be closely monitored to avoid flare-ups during pregnancy (Nevares, 2022).

Skin Cancer

The most common type of cancer is skin cancer, which has three main types: basal cell carcinoma, squamous cell carcinoma, and malignant melanoma (Figure 21.10). Patients with fair skin and lower melanin production and patients who spend significant time in the sun are at higher risk of all types of skin cancers. However, patients with darker skin and those who spend minimal time outdoors can still develop skin cancer.

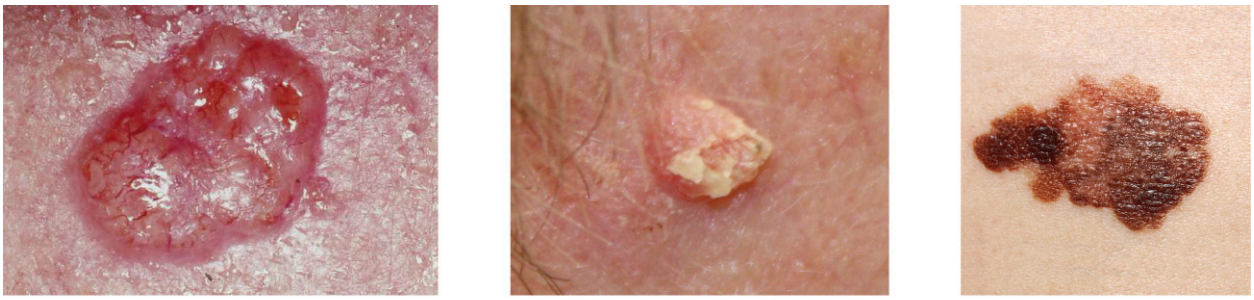


FIGURE 21.10 The three main types of skin cancer include (a) basal cell carcinoma, (b) squamous cell carcinoma, and (c) melanoma. (credit a: modification of work "Basal cell carcinoma.jpg" by John Hendrix/Wikipedia, Public Domain; credit b: modification of work "Skin Cancer, Squamous Cell Carcinoma, Face" by Kelly Nelson, M.D./National Cancer Institute, Public Domain; credit c: modification of work "Melanoma" by Unknown/National Cancer Institute, Public Domain)

Basal Cell Carcinoma

The most common type of skin cancer is **basal cell carcinoma**, and it is generally found on the head or neck. This type of skin cancer rarely metastasizes to other parts of the body but does invade and gradually destroy surrounding tissues. Basal cell carcinomas grow slowly and can go unnoticed because of the gradual change. These tumors can grow near the eyes, mouth, nose, or ears. They can be serious but are not usually fatal. Most tumors generally grow into the skin. The lesions are small, shiny bumps that may break open, form a scab, and sometimes bleed or flatten and look like scarring. Although a healthcare provider can easily identify this type of lesion, a biopsy should be performed to confirm the type of cancer. Treatment options include removal of the tumor by curettage and electrodesiccation, cutting it out, or cryosurgery. Topical chemotherapy medications may be applied to the skin.

Other options include **photodynamic therapy** (using lasers and chemicals on the skin) and radiation therapy. Larger areas of basal cell carcinoma may require the **MOHS procedure**, where layers of the skin are removed and examined for cancer cells until no signs of cancer remain. The healthcare provider (often a dermatologist) may use sutures, skin flaps, or skin grafts to replace the removed skin or refer the patient to a plastic surgeon for closure (Nambudiri, 2024).

Squamous Cell Carcinoma

The second most common type of skin cancer is **squamous cell carcinoma** that generally develops on sun-exposed areas but can grow where sun exposure is limited. Squamous cell carcinoma is the cancer of squamous cells, keratinocytes, the main epidermal structural cells. This type of skin cancer is more likely with patients who have precancerous growths like actinic keratoses, scarred skin, and chronic mucus membrane or skin sores. This skin cancer generally starts as a red area with a crusted, scaly surface that may turn into a raised, firm wartlike surface. This lesion can become an open sore and grow into the underlying tissues. Biopsy is also best for diagnosing this type of cancer. The prognosis is generally excellent with early intervention. This type of cancer can metastasize and become fatal if not treated in time. Treatment options are similar to basal cell carcinoma but also include using an immune checkpoint inhibitor (e.g., PD-1 inhibitor [cemiplimab]). For patients who have large lesions that have metastasized or spread to the tissues underneath or cannot have surgery, PD-1 inhibitors help the body's immune system annihilate the cancer (Nambudiri, 2024).

Malignant Melanoma

The most dangerous of the skin cancers is **malignant melanoma** that originates in the melanocytes. As sunlight increases melanin production, the risk of skin cancer increases. Melanoma metastasizes to distant parts of the body and can often go undetected, making it fatal. Those with undetected melanoma may not be diagnosed until affected organs of the body start displaying symptoms.

Melanoma may begin as a small, pigmented growth in a sun-exposed area or develop in a preexisting mole but can also occur in the mouth, on the genitals or rectal area, in the brain, in nail beds, or in or around the eyes. Risk factors for melanoma include those mentioned for other skin cancers but also include those with previous history of skin cancer, large number of moles, weakened immune system, fair skin, freckles, family history of melanoma, advanced age, and large congenital melanocytic nevus.

Melanomas usually are identifiable by an atypical mole with irregular borders and inconsistent colors. Some may be flat, irregular, brown patches with small black spots or can be raised brown patches with blue, black, red, or white spots. Melanoma can also be red, black, gray, and firm. A biopsy is needed for diagnosis. Nurses should understand the ABCDEs of melanoma and help educate patients on these warning signs (Table 21.6).

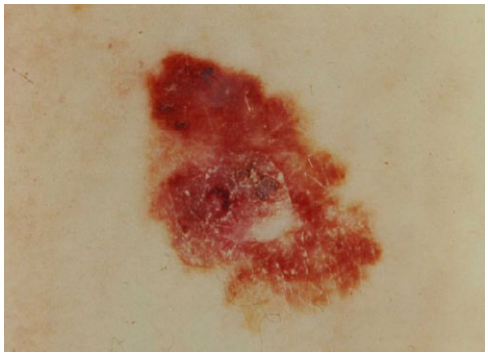
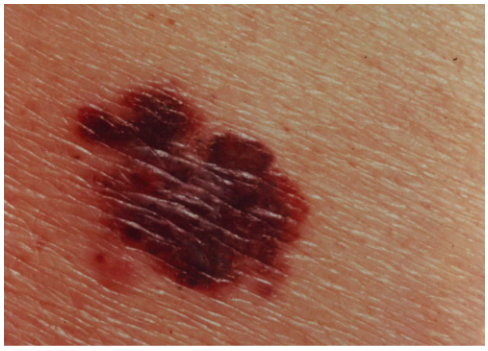
Letter	Meaning	Examples
A	Asymmetry = two halves of a mole are not equal	 (credit: modification of work "Skin Cancer, Melanoma, Red And Brown Lesion 2" Laurence Meyer, MD, PhD, University of Utah Health Sciences Center/National Cancer Institute, Public Domain)
B	Borders = borders are irregular and seem to blend in or are not oval or round	(credit: modification of work "Skin Cancer, Melanoma, Brown Lesion" by Laurence Meyer, MD, PhD, University of Utah Health Sciences Center/National Cancer Institute, Public Domain)
C	Color = existing mole changes color or moles that have drastically different colors than other moles present on the body	 (credit: modification of work "Skin Cancer, Melanoma, Red And Brown Lesion 1" by Laurence Meyer, MD, PhD, University of Utah Health Sciences Center/National Cancer Institute, Public Domain)

TABLE 21.6 The ABCDEs of Melanoma

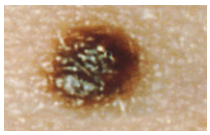
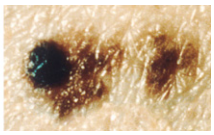
Letter	Meaning	Examples
D	Diameter = more than ¼ inch (0.6 cm) wide	(credit: modification of work "Skin Cancer, Melanoma, Foot" by Kelly Nelson, MD/National Cancer Institute, Public Domain)
E	Evolution = mole that changes (bleeds, enlarges, becomes tender, itches) or development of a new mole after the age of 30 years	  (credit a: modification of work "Common Mole" by National Cancer Institute, Public Domain; credit b: modification of work "Melanoma" by National Cancer Institute, Public Domain)

TABLE 21.6 The ABCDEs of Melanoma

Treatment options for melanoma are similar to options for the basal cell and squamous cell carcinomas but also include targeted therapy and immunotherapy when the cancer has spread. Targeted therapy consists of medications that attack the cancer cell's biologic mechanisms and include vemurafenib (Zelboraf) or binimetinib (Mektovi). Patients who have shallow melanomas may be treated with imiquimod cream (Aldara). Chemotherapy may also be needed if the cancer has spread or when no other treatment options are available. Treatment options may be used in combination with other treatments. Radiation therapy is often used when complete removal of the tumor is not achievable or when it has metastasized to the brain (Nambudiri, 2024). If the melanoma is aggressive and has been deemed untreatable or incurable, the patient may need to receive comfort care or hospice care.

Everyone should be screened regularly for skin cancer by a healthcare provider or dermatologist. Nurses should take any opportunity to educate people about sun exposure and ways to help prevent skin cancer. A key point to educate patients on is how to observe changes or unusual skin markings that they should report to their healthcare provider. Additionally, nurses should educate patients about avoiding the sun or seeking shaded areas, especially when the sun's rays are the strongest (between 10 a.m. and 4 p.m.), wearing sunscreen with an SPF factor of at least thirty or greater, wearing protective clothing (e.g., hats, sunglasses, long sleeves), and avoiding the use of tanning beds (Nambudiri, 2024).

PATIENT CONVERSATIONS

Tanning Beds and Cancer Risks

Scenario: A nurse is performing an annual checkup on a patient who subsequently states they have been an avid tanning bed user for more than thirty years.

Nurse: Hi. My name is Susie, and I will be your nurse today. May I have your name and date of birth?

Patient: Yes. Hi, my name is Tiffany Ball, date of birth is May 12, 1975.

Nurse: What medications are you currently taking?

Patient: None.

Nurse: Any known medication allergies?

Patient: No.

Nurse: The last time we saw you, your surgical history included a cesarean section. Is that correct? Any other surgeries?

Patient: Nope. Just that one so far.

Nurse: Thank you. Have you noticed any new spots on your skin or anything that may concern you?

Patient: I have not noticed anything.

Nurse: Okay, well if you are ready, I will let the provider know you are ready for the skin check.

[The provider comes in and, while performing the annual examination, notices a suspicious mole on the patient's upper back. The provider removes it with the patient's permission and sends it off to pathology for a biopsy. The provider leaves the room.]

Patient: Wow. So, what causes skin cancer? I hardly go outside.

Nurse: Do you have a family history of skin cancer? Do you use tanning beds?

Patient: I think my dad had a spot removed a few years ago. I have been tanning in a tanning bed since high school, so maybe thirty years or so. I was told a tanning bed was safer.

Nurse: Tanning beds do increase your risk of developing skin cancer due to the UV rays (e.g., UVA and UVB) that may be used in a tanning bed.

Patient: Oh, so since I already have a spot anyway, I can still tan, right?

Nurse: Your results will come back from the laboratory, and then we can confirm whether or not it is cancerous. It is best to minimize your risks for skin cancer. Just because you have one potential spot does not mean you could not have another. The risks for skin cancer include family history and sun exposure, especially between 10 a.m. and 4 p.m. If you are going to be in the sun, use sunscreen with an SPF of at least thirty, find shade often, and wear protective clothing like long sleeves, pants, and wide-brimmed hats.

Patient: So, what are you saying about using tanning beds?

Nurse: Tanning beds do not offer a safe alternative to sunlight. Unfortunately, they also increase the risk for skin cancers, including melanoma, the deadliest form of skin cancer.

Health Promotion and Behavioral Considerations

Health promotion as it relates to skin integrity includes lifestyle choices and behaviors that promote healthy skin. Those with impaired skin integrity should be careful with their hygiene practices and behaviors to avoid further aggravating their skin conditions. Some behaviors that help protect the skin include the following:

- using pH-balanced or mild soaps when bathing
- patting dry versus rubbing, which makes skin more prone to friction tears or other skin damage
- using emollients that moisturize and soften the skin
- avoiding the use of detergents that contain fragrance
- avoiding the use of deodorant soaps
- eliminating triggers

Any possible infectious skin lesions should be observed for signs of improvement or worsening. Drainage is a possibility from skin lesions; therefore, nurses should follow standard and transmission-based precautions when assessing the skin or changing dressings. Standard precautions may include wearing gloves, gowns, masks, or face shields as needed and disposing of them properly after use. Any contaminated dressings should also be disposed of

according to organizational policies. Patients who have lesions may need to be educated on proper at-home wound care (see 8.3 Wound Management).

Nurses should educate patients and families on adequate hygiene and proper skin care (see Chapter 7 Hygiene) for prevention of impaired skin integrity. Other behaviors that promote adequate skin integrity should also include understanding the importance of routine skin checks, minimizing sun exposure during the time of day when the UV rays are the strongest, wearing protective clothing while in the sun, and using sunscreen. Age-related and cultural considerations should be taken into consideration when educating on health promotion behaviors for impaired skin integrity.

Age-Related Considerations

Newborns have thinner skin that is more sensitive and susceptible to rashes (e.g., contact dermatitis), newborn acne, and seborrheic dermatitis. Newborns cannot care for themselves; therefore, caregivers should be educated on the need to keep the newborn and caregiver nails trimmed to avoid scratching the baby. They should also be educated on signs and symptoms of common skin irritations as well as prevention actions and treatment options.

Toddlers and preschoolers are more prone to accidents because of their high activity levels and difficulties with mobility. They may fall or run into inanimate objects which may lead to lacerations, burns, or other abrasions. Caregivers should be educated to implement safety precautions to prevent injuries. For example, padding sharp corners may prevent accidents.

Head lice, impetigo, scabies, and rashes are more common in school-age children and adolescents. Acne vulgaris generally starts during adolescence and can lead to an impaired body image, which may require counseling. This age group typically wants to be more independent, so education may be needed to ensure proper skin care.

Skin changes as people age (see 21.1 Structure and Functions of the Skin). Older adults should focus on adequate nutrition and hydration, especially ensuring adequate protein intake to promote wound healing. Older adults may have impaired mobility making adequate hygiene difficult or impossible for this age group to perform. Therefore, it is important that the nurse or caregiver promote appropriate skin care, prevention, and intervention with impaired skin integrity. Some skin changes are benign like cherry angiomas, seborrheic keratoses, spider angiomas, wrinkles, dryness (**xerosis**), neurodermatitis, liver spots, melasma, **telangiectasias** (red marks on the skin caused by widening of shallow blood vessels), and hair loss.

LIFE-STAGE CONTEXT

Life Span Considerations for Skin Integrity

Skin in the very young is more fragile and thinner than the skin of an adult. The skin and mucous membranes are more susceptible to injury and infection. As the child ages, their skin becomes more resistant to infection and injury. Special care is needed when handling and caring for infants to prevent harm. For example, a baby's fingernails should be filed or mittens worn to prevent the infant from scratching themself. Additionally, infants must be bathed in lukewarm water to prevent burn injuries.

Cultural-Related Considerations

Nurses should remember that cultural considerations regarding skin conditions are common but may be different among various cultures and ethnic groups (see 21.1 Structure and Functions of the Skin). Patients with fair skin produce less melanin and are more at risk of skin cancers than darker-skinned individuals. However, patients with darker skin are more susceptible to postinflammatory hyperpigmentation, dermatosis papulose nigra, keloids, hair loss, pityriasis, vitiligo, and dry skin. Other considerations include cultures that may not believe in medical interventions. For example, people who follow the Amish religion may not believe in accepting outside medical care or interventions. The nurse should not make assumptions but should assess beliefs and preferences as well as provide education to the patient and their family members regarding the skin disorder, treatment options, and risks of not being treated. The patient should be allowed to decide what interventions they do or do not want to receive without bias from the nurse. The nurse should also analyze a patient's cultural preferences when developing a plan of care to promote healing and improve skin integrity.

Summary

21.1 Structure and Functions of the Skin

The epidermis, dermis, and hypodermis are the three distinct layers of the skin. The epidermis is the outermost portion and is made up of stratified epithelial cells. The dermis is the second layer of skin that consists of elastic connective tissue made up of collagen. The bottom layer, the hypodermis or subcutaneous tissue, anchors the skin to the underlying tissues. The functions of the skin include protection, thermoregulation, sensation, absorption, elimination, and vitamin D production. These functions each play a major role in maintaining health and homeostasis of a person. The skin has psychosocial effects and serves to aid in identification. Assessment findings may vary among cultures and ethnicities, developmental levels, and age groups.

21.2 Factors Affecting Skin Integrity

Normal healthy skin is based on the age, ethnicity, genetics, and health condition of the patient. Patients are at risk of impaired skin integrity if they have risky lifestyle and behavioral factors (e.g., poor nutrition, activity levels, sexuality, illicit drug use, body piercings, tattoos). State of health (e.g., illnesses, medications, mobility status) and genetic (e.g., vitiligo, acne, melanoma, psoriasis, eczema) factors may also pose a risk. Common skin disorders include bacterial infections, viral infections, fungal infections, inflammatory reactions, and skin cancers. Common bacterial infections of the skin include impetigo, folliculitis, carbuncles, and cellulitis. Viral skin infections include herpes simples, herpes zoster, and verruca. Common fungal skin infections include tinea that affect the feet and toes, beard, body, groin, and scalp. Parasitic skin infections include pediculosis (affects the body, scalp, and groin) and scabies. Inflammatory skin reactions include eczema, seborrheic dermatitis, urticaria, acne vulgaris, psoriasis, and SLE. Skin cancer has three main types: basal cell carcinoma, squamous cell carcinoma, and malignant melanoma. People with impaired skin integrity may need to make lifestyle modifications to promote healing. Nurses must take age-related and cultural factors into consideration when developing a plan of care and educating patients, their family members, or their caregivers to promote skin health.

Key Terms

acne vulgaris a common inflammatory skin reaction caused by bacteria, dead skin cells, or dried sebum that clogs hair follicles and prevents sebum from passing up through the pores

angioedema swelling of the face, lips, throat, or airways

apocrine gland correlates with the hair follicles present in the perineum, axillae, and areolae of the breasts

arrector pili muscle triggers hair follicle on the body to flex causing the hair to rise up

basal cell carcinoma the most common skin cancer that is generally found on the head or neck; it may be serious but is not usually fatal

blackhead flesh-colored, small bump with a dark center

bulla large blister

bullous impetigo type of impetigo that has large, flaccid bullae on the skin that rupture and leave a thin brown crust

carbuncle skin abscess that connects to others below the surface of the skin to form clusters, often forming when one of more hair follicles become infected

cellulitis localized infection and inflammation of the skin and tissues that are immediately beneath the skin

comedone extraction use of a comedone extractor by a healthcare professional to remove blackheads and whiteheads by incising the pore and then using gentle pressure around the pore opening with a wire loop

cystic acne lesions that are usually large, red, painful, and pus-filled nodules that merge under the skin and often leave scars

defensin has antimicrobial and/or cytotoxic properties and is part of the body's first immune defense

dermatosis papulose nigra small dark or skin-colored bumps on the face, neck, and upper torso, common in people with darker skin colors

dermis the layer of skin below the epidermis connected to the epidermis by dermal papillae

disseminated zoster herpes zoster rash that affects three or more dermatomes

eccrine gland is located over the skin entirely, secretes sweat, and aids in thermoregulation

ecthyma (deep impetigo) a skin infection that occurs deep inside the skin characterized by shallow, small ulcers that look punched-out and may contain pus

eczema (atopic dermatitis) rash characterized by itchy, chronic inflammation of the upper skin layers and is associated with a heightened immune response
emollient ingredient that soothes skin dryness
erythema a change in skin color due to a change in blood flow
filiform wart long, small, narrow growth that appears on the lips, face, or eyelids
flat wart may appear in areas that are shaved or along stretch marks
folliculitis an infection of the skin follicle
genital wart (condyloma acuminata, venereal wart) occurs on the vagina, vulva, cervix, or penis
herpes simplex viral infection that can cause painful blisters or ulcers
herpes zoster (shingles) maculopapular rash associated with shingles most often appears on the trunk of the body along a thoracic dermatome
hydroxylation the chemical process in which a hydroxyl group (–OH) is introduced into an organic compound
hyperpigmentation darkened patches of skin (liver spots)
hypodermis the subcutaneous fatty layer beneath the dermis that anchors the dermis to the underlying tissues of the body
hypopigmentation lighter patches of skin (age spots)
impetigo highly contagious bacterial skin infection that forms pustules and yellow crusty sores
Kaposi sarcoma a rare type of cancer caused by a virus
keloid a thick fibrous scar caused by excessive collagen formation in response to trauma or a surgical incision
keratin fibrous water-repellent protein gives the epidermis its strong, protective quality
keratinization a thickening of plasma membranes of a cell
keratinocyte cell that produces keratin
Langerhans cell antigen-processing cell that determines the appropriate response to (inflammation) or tolerance of foreign substances
maceration the softening of tissues caused by prolonged wetting or soaking
malignant melanoma the most dangerous type of skin cancer; originates in the melanocytes
melanin dark brown to black pigment protects the keratinocytes and nerve endings from ultraviolet light damage that appears in the skin and hair
melanocyte cell that produces melanin and keratinocyte
Merkel cell found in the stratum basale and serves as a sensory receptor for light touch
mitotic activity the degree in which a population of cells proliferates
MOHS procedure layers of the skin are removed and examined for cancer cells until no signs of cancer remain
mosaic wart wart that grows in clusters
nonbullous impetigo type of impetigo that has pustules that rapidly break down and form thick, adherent, honey-colored crusts on the face and extremities
osteomalacia bone demineralization
palmar wart wart on the palm of the hand
papillary layer thin, dermal layer of the dermis composed of loose connective tissue, which contacts the epidermis
pediculosis lice infestation
pediculosis capitis lice infestation of the scalp
pediculosis corporis lice infestation of the body
pediculosis pubis lice infestation of the hairs of the anal and genital areas but can also infest the thigh, chest, and facial hair
perspiration (sweat) excess water and salts that are eliminated from the body via sweat glands
photodynamic therapy using lasers and chemicals on the skin
pimple has a small area of red skin and can be painful or cause discomfort
pityriasis any of various skin conditions characterized by dry scaling patches of skin
plantar wart wart on the sole of the foot
postinflammatory hyperpigmentation temporary pigmentation that occurs after an injury or inflammatory skin condition, most commonly seen in people with darker skin types
prodromal state period between the appearance of initial symptoms and the full development of an illness causing headache, malaise, chills, or photophobia

pruritus itching
psoriasis a recurring, chronic skin condition that causes one or more raised areas of red skin patches with silvery scales and a distinct border
pustule similar to a pimple but contains white or yellow pus
Raynaud phenomenon a condition that causes pale or blue fingers with cold exposure
reticular layer thick, dermal layer of the dermis that consists of dense connective tissue, collagen bundles, and houses most of the sweat glands, sebaceous glands, hair follicles, hair, muscles, blood vessels, and deep sensory neurons
scabies tissue that produces red and white blood cells and platelets; where hematopoiesis takes place
sebaceous gland secretes sebum, an oily substance that makes the hair and skin waterproof
seborrheic dermatitis inflammatory skin reaction primarily on the scalp and face
squamous cell carcinoma the second most common type of skin cancer that generally develops on sun-exposed areas but can grow where sun exposure is limited
stratum basale (stratum germinativum) deepest layer of the epidermis that contains melanocytes and keratinocytes
stratum corneum thickest and outermost layer of the epidermis that secretes defensins as part of the body's first immune defense
stratum granulosum layer above the stratum spinosum that contains a glycolipid, which slows water loss across the epidermis
stratum lucidum layer of skin only found in thick areas like the soles of the feet and palms of hands
stratum spinosum layer above the stratum basale and contains cytoplasmic processes (spines) that extend outward and contact neighboring cells
subcutaneous tissue the subcutaneous fatty layer (hypodermis) beneath the dermis that separates the skin from the underlying tissue
systemic lupus erythematosus (SLE) a chronic autoimmune inflammatory disorder involving connective tissues of the joints, skin, kidneys, mucous membranes, and blood vessel walls
telangiectasias red marks on the skin caused by the widening of shallow blood vessels
tenting the skin does not snap back when pinched; instead, it maintains a tentlike shape, which may indicate dehydration
tinea (ringworm) may be found on the feet, beard, body, groin, scalp, or toes
tinea barbae (beard ringworm) fungal infection of the beard
tinea capitis fungal infection of the scalp
tinea corporis fungal skin infection of the arms, trunk, legs, and face
tinea cruris fungal infection of the groin
tinea pedis (athlete's foot) fungal infection of the feet
tinea unguium (onychomycosis) fungal infection of the toenail or fingernail
transdermal administration placed on the skin and absorbed either locally or systemically
urticaria (hives) rash of raised, swollen, flesh-colored or red bumps or welts on the skin
varicella (chickenpox) caused by the varicella-zoster virus
verruca (wart) raised or flat growth caused by the viral infection human papillomavirus
vesicle small blister
vitiligo chronic autoimmune disorder that causes partial or total loss of skin color in patches
whitehead flesh-colored small bump that does not have a dark center
xerosis skin dryness

Assessments

Review Questions

1. What term would the nurse document when describing the depth of a laceration through the second layer of skin?
    a. Langerhans
    b. keloid
    c. keratin

d. dermis

2. Which layer of the epidermis is only present in the soles of the feet?
   a. stratum basale
   b. stratum granulosum
   c. stratum lucidum
   d. stratum spinosum

3. What is the primary function of the skin?
   a. protection
   b. store and release fat
   c. vitamin B production
   d. digestive enzyme production

4. The nurse is educating a patient on how their skin helps with temperature regulation. The nurse explains to the patient that when the body temperature decreases, the blood vessels do what?
   a. vasoconstrict to increase blood flow
   b. vasoconstrict to decrease blood flow
   c. vasodilate to increase blood flow
   d. vasodilate to decrease blood flow

5. The nurse caring for a dark-skinned patient knows that the patient is more susceptible to
   a. freckles
   b. keloids
   c. skin cancer
   d. sunburns

6. The pediatric nurse is educating a new mother on risk factors that may contribute to her young infant's risk for hypothermia. The nurse knows the mother understood the teaching when she makes what statement?
   a. "My child is at risk for hypothermia because he has a lesser amount of subcutaneous tissue, meaning his blood vessels are farther away from the surface."
   b. "My child is at risk for hypothermia because he has more subcutaneous tissue, meaning his blood vessels are farther away from the surface."
   c. "My child is at risk for hypothermia because he has more subcutaneous tissue, meaning his blood vessels are closer to the surface."
   d. "My child is at risk for hypothermia because he has a lesser amount of subcutaneous tissue, meaning his blood vessels are closer to the surface."

7. What is an example of a lifestyle choice that is a behavioral risk factor for impaired skin integrity?
   a. diabetes
   b. illicit drug use
   c. a medication for congenital heart disease
   d. impaired mobility

8. A 67-year-old patient presents to the clinic with redness, edema, and fluid-filled vesicles on the right leg that is hot to the touch. The patient also complains of pain and tenderness. The patient's heart rate is 110 and temperature is 100.8°F (38.2°C). The nurse should suspect what skin abnormality?
   a. folliculitis
   b. carbuncles
   c. impetigo
   d. cellulitis

9. The nurse is caring for an adult who has just been diagnosed with shingles. The nurse knows the patient

understood the teaching when the patient says what?

a. "Varicella lies dormant after having the vaccination or chickenpox. It can reactivate later in life and present as shingles."
b. "Shingles can only occur if you have had the varicella vaccine."
c. "I had chickenpox as a kid, so I should not be getting this virus."
d. "Shingles only affects women."

10. You are educating a patient on preventing skin cancer. You know the patient understood the teaching when they say what?

a. "I will only go to the tanning salon twice a week."
b. "I will avoid the sun from 9 a.m. to 1 p.m. when the UV rays are the strongest."
c. "I will wear protective clothing, like long sleeves, hats, and sunglasses, and will use sunscreen at the lake this weekend."
d. "I will use a sunscreen that has an SPF factor of five or greater."

11. What is *not* a benign skin change found in older adults?

a. cherry angiomas
b. wrinkles
c. carbuncle
d. melasma

Check Your Understanding Questions

1. Describe the layers of the skin, including name, location, and primary function.

2. Describe the layers of the epidermis.

3. What skin condition is shown in the picture?

(credit: modification of work by National Cancer Institute, Public Domain)

a. basal cell carcinoma
b. pustule
c. tinea corporis
d. verruca

Reflection Questions

1. What information should a nurse include when educating a caregiver about administering transdermal medications to their loved one at home?

2. Describe how the skin provides protection.

What Should the Nurse Do?

1. The nurse is caring for a patient with malignant melanoma that has metastasized to the brain, spine, lungs, and liver. The patient states they do not want any medical treatment or interventions. What should the nurse do?

Competency-Based Assessments

1. Prepare a fifteen-minute presentation on the anatomy of the skin.

2. Prepare a fifteen-minute presentation on the functions of the skin.
3. Develop an infographic comparing bacterial infections of the skin.
4. Prepare a script for teaching a dark-skinned patient about the types of skin conditions more prevalent in dark-skinned people.

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CHAPTER 22

Assessment of the Head and Neck

FIGURE 22.1 A comprehensive nursing assessment of the head and neck can identify abnormalities in the patient's ability to hear, see, smell, and taste. (credit: modification of "US Navy 030424-N-6967M-240 Lt. j.g. Elavonta Thomas conducts a routine check on one of the patients in the Intensive Care Units (ICU) aboard USNS Comfort (T-AH 20).jpg" by U.S. Navy/Wikimedia Commons, Public Domain)

CHAPTER OUTLINE

22.1 Head and Neck
22.2 Eyes
22.3 Ears
22.4 Mouth, Throat, Nose, and Sinuses

INTRODUCTION The art and science of nursing encompasses a comprehensive approach to patient care, rooted in thorough assessments that lay the foundation for accurate diagnoses and effective interventions. One of the pivotal aspects of this approach is the assessment of the head and neck. Included in the assessment of the head and neck is the assessment of the eyes, ears, mouth, throat, nose, and sinuses. This chapter delves into the intricacies of conducting an assessment of the head and neck, equipping nurses with the knowledge and skills needed to identify normal and abnormal assessment findings.

22.1 Head and Neck

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the structure and functions of the head and neck
- Describe nursing assessments of the head and neck
- Recognize abnormalities of the head and neck

The head and neck represent a complex and vital anatomical region, encompassing numerous structures and

functions crucial to human health and well-being. These structures are vital for our ability to interact with the world, communicate, breathe, eat, and protect important internal organs. As such, it is important for the nurse to be able to perform a comprehensive assessment of the head and neck and to be able to identify deviations from normality.

Structure and Functions

Performing a comprehensive assessment of the head and neck requires a solid grasp of their structural intricacies and functional roles. It is imperative for nurses to have an understanding of the anatomical aspects of the head, neck, and accompanying lymph nodes, as this knowledge serves as the foundation for an accurate assessment and administration of appropriate treatments. Furthermore, this understanding helps differentiate between normal anatomical variations and potential signs of health issues, ensuring a comprehensive and accurate assessment.

The Head

The head is a complex anatomical region that houses the brain, sensory organs, and various structures responsible for functions such as eating, breathing, and communication. Beyond housing the brain, the head houses the sensory organs responsible for vision, hearing, smell, taste, and touch. To better understand the functional significance of the head, let us further explore the anatomy of the cranium and face.

CULTURAL CONTEXT

Ethnic Facial Variations

Facial features and expressions can vary significantly among different ethnic groups, reflecting a combination of genetic, environmental, and cultural factors. It is important to approach discussions about facial variations with cultural sensitivity and an understanding that individual variation exists within every ethnic or cultural group. Here are some general observations about facial variations among ethnicities, though keep in mind that these are generalizations and not universally applicable to every individual within a culture:

1. **Asian ethnicities:**
   - Epicanthic folds: Many East and Southeast Asian populations have epicanthic folds, which are skinfolds that cover the inner corners of the eyes, giving a distinct eye shape.
   - Flatter facial profiles: Asians often have flatter facial profiles, with less pronounced nasal bridges and cheekbones.
   - Monolid or double eyelids: Eye shapes vary, with some individuals having monolid eyes and others having double eyelids.
2. **African and Black ethnicities:**
   - Broad nose and full lips: Many individuals of African descent have broader noses and fuller lips, with a range of variations in shape and size.
   - Darker skin tones: Skin tones can range from dark to light, with a variety of undertones.
3. **European and Western ethnicities:**
   - Diverse features: European and Western countries have diverse populations due to historical migrations and interactions, resulting in a wide range of facial features.
   - Lighter skin tones: Lighter skin tones are more common, but there is a broad spectrum of variation.
4. **Indigenous and Native ethnicities:**
   - Distinctive features: Indigenous peoples from various regions often have unique facial features tied to their specific geographic origins. For example, facial features are often characterized by high cheekbones and large, deep-set eyes that may be almond-shaped or slightly slanted.
   - Facial paint and ornamentation: Some cultures engage in traditional facial paint, piercings, or other forms of ornamentation as part of cultural practices.
5. **Middle Eastern and South Asian ethnicities:**
   - Prominent noses: Many individuals from these regions have prominent noses with various shapes and sizes. This feature is identified by a nose shape larger than average.
   - Dark hair and eyes: Dark hair and eyes are common, although there is still a range of variation.
6. **Pacific Islander and Oceanic ethnicities:**
   - Broad facial features: Many Pacific Islander populations have broad facial features, including wide noses

and strong jawlines.
    - Darker skin tones: Skin tones can range from light to dark, often with warm undertones.

It is essential to approach facial variations within cultures with respect and avoid making assumptions about an individual's background based solely on their appearance. People can have mixed heritage, and cultural influences can intersect and blend in various ways.

Cranium

The cranium, commonly known as the skull, is the bony structure that encloses and protects the brain as well as various sensory organs and structures in the head. It is composed of several bones (Figure 22.2) that are connected by **sutures**, which are fibrous joints that allow for limited movement during childbirth and growth but eventually fuse to provide stability and protection. The main bones that make up the cranium include the following:

- Frontal bone: The **frontal bone** forms the forehead and the upper portion of the eye sockets (or orbits). It also contains the frontal sinuses, which are air-filled cavities that contribute to the resonance of the voice.
- Parietal bones (left and right): The **parietal bones** form the majority of the upper sides and the roof of the cranium. They are joined at the midline by the sagittal suture.
- Temporal bones (left and right): The **temporal bones** are located on the sides and base of the skull. They contain the ear structures, including the external auditory canal, middle ear cavity, and inner ear. The temporal bones also have an important role in housing the mandibular fossa, where the lower jaw articulates.
- Occipital bone: The **occipital bone** forms the back and base of the cranium. It contains the foramen magnum, a large opening through which the spinal cord passes to connect to the brain. The occipital bone also has attachment points for neck muscles.
- Sphenoid bone: The **sphenoid bone** is a complex bone that sits at the base of the skull, contributing to the sides of the skull, the base of the cranium, and the posterior portion of the orbits. It houses the pituitary gland and contains several important foramina (openings) for nerves and blood vessels.
- Ethmoid bone: The **ethmoid bone** is located between the eye sockets and forms part of the nasal cavity. It contains thin plates that contribute to the structure of the nasal septum and the walls of the nasal cavity.

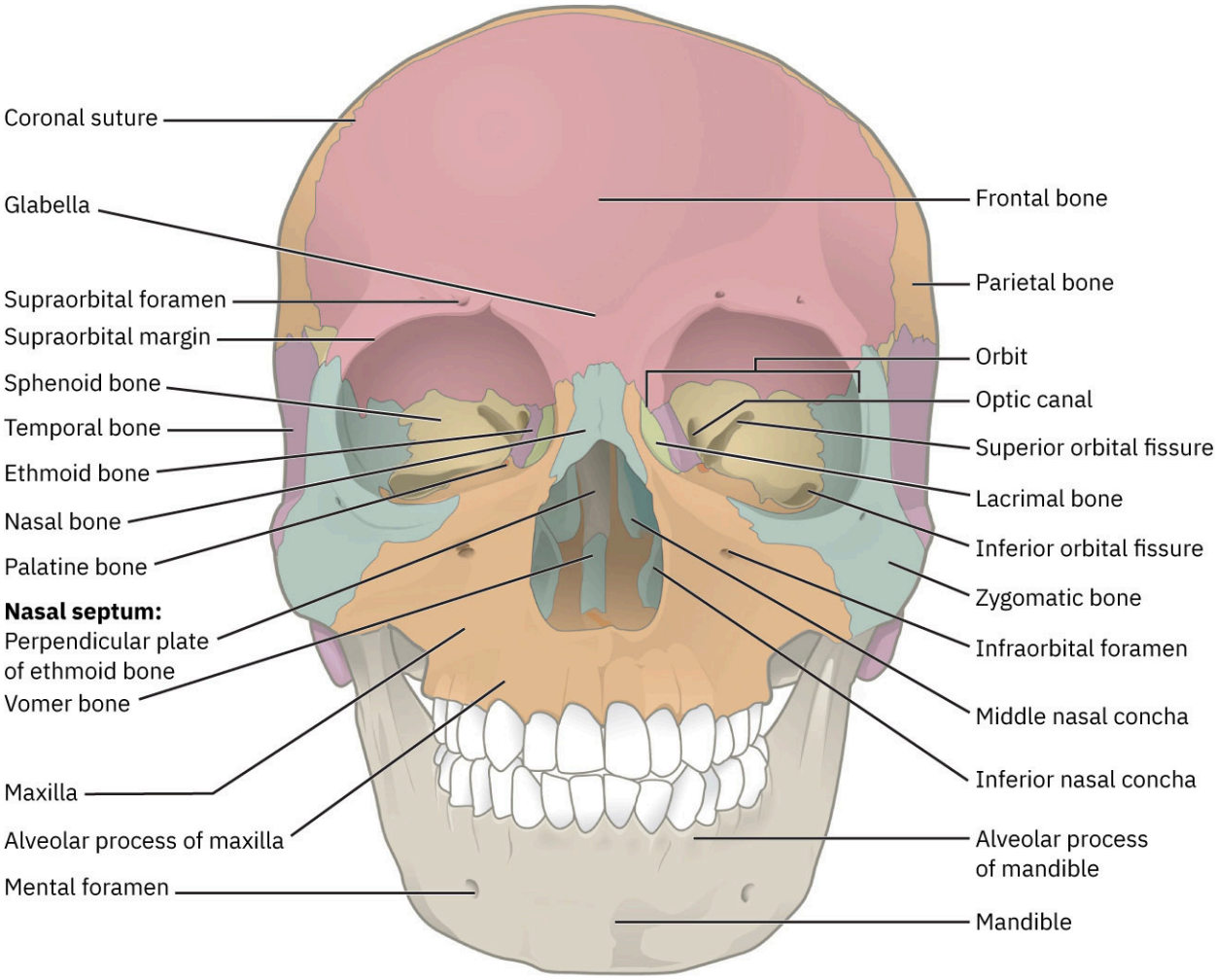


FIGURE 22.2 The intricate arrangement of the cranial bones, with this figure highlighting their unique shapes and connections in the human skull, protects and supports the brain. (credit: modification of work from *Anatomy and Physiology.* attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

These bones protect the brain and provide structural support for the head. Additionally, they provide attachment points for muscles that control facial expressions, mastication (chewing), and various head movements. The openings within the cranial bones allow for the passage of blood vessels, nerves, and other important structures that connect the brain with the rest of the body.

In a newborn, the pressure from vaginal delivery compresses the head and causes the bony plates to overlap at the sutures (Figure 22.3), creating a small ridge. Over the next few days after birth, the head expands, the overlapping disappears, and the edges of the bony plates meet edge to edge. This is the normal position for the remainder of the life span, and the sutures become immobile. There are several main cranial sutures:

- Coronal suture: The coronal suture runs horizontally across the skull, connecting the frontal bone to the parietal bones on each side. It is located at the anterior (front) portion of the skull.
- Sagittal suture: The sagittal suture runs vertically along the midline of the skull, connecting the two parietal bones. It divides the skull into right and left halves.
- Lambdoid suture: The lambdoid suture is located at the posterior (back) part of the skull. It separates the occipital bone from the parietal bones on each side. The suture's shape resembles the Greek letter "lambda" (Λ).
- Squamous sutures: There are two squamous sutures on each side of the skull:
  - Temporal squamous suture: This suture separates the temporal bone from the parietal bone on each side.
  - Pterion: The **pterion** is a point where the frontal, parietal, sphenoid, and temporal bones meet. It is an

important landmark because the middle meningeal artery lies beneath it and can be vulnerable to injury in head trauma.

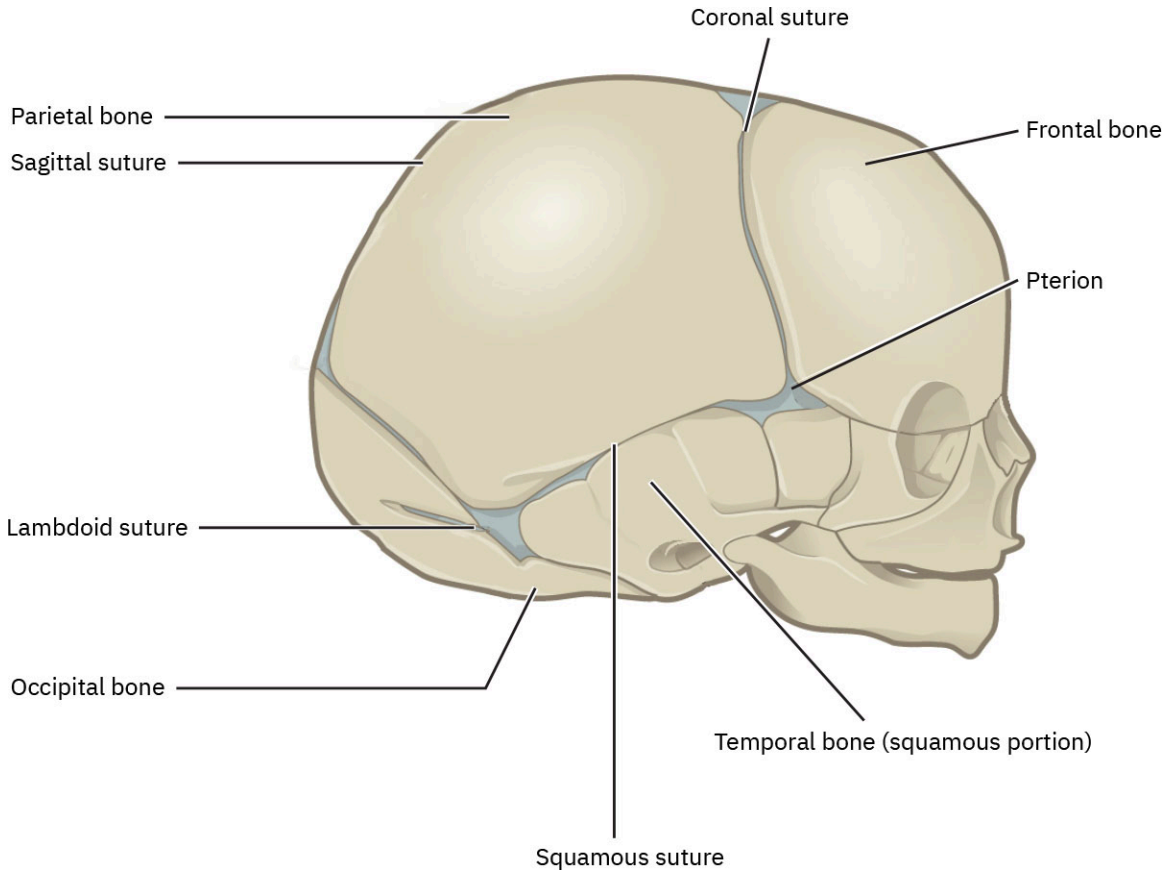


FIGURE 22.3 Cranial sutures connect the cranial bones together. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Face

In addition to the cranial bones, the cranium includes the facial bones, which contribute to the formation of the face and its features. These facial bones include the orbit, nasal bones, mandible, maxilla, and zygomatic bones. The **orbit** is the bony socket that houses the eyeball and the muscles that move the eyeball. Inside the nasal area of the skull, the nasal cavity is divided into halves by the nasal septum that consists of both bone and cartilage components. The **mandible** forms the lower jaw and is the only movable bone in the skull. The **maxilla** forms the upper jaw and supports the upper teeth. The **zygomatic bone**, also known as the cheekbone, functions as a structure that joins the bones of the face while protecting the arteries, nerves, veins, and organs below the surface. Together, the cranial and facial bones create a complex and protective framework for the structures within the head.

The facial muscles are a group of muscles that control the movements of the face, allowing us to express emotions, communicate, and perform various facial actions. There are around forty-three facial muscles that are arranged in intricate patterns to create the wide range of expressions from smiling and frowning, to raising an eyebrow or wrinkling the forehead. Several nerves innervate the facial muscles to create facial expressions. Figure 22.4 illustrates the nerves that affect the facial muscles. These nerves and muscles are tested during a cranial nerve examination. For example, when a patient is experiencing a cerebrovascular accident (e.g., stroke), it is common for facial drooping to occur. In **facial drooping**, an asymmetrical facial expression occurs due to damage of the nerve innervating a specific part of the face (Figure 22.5).

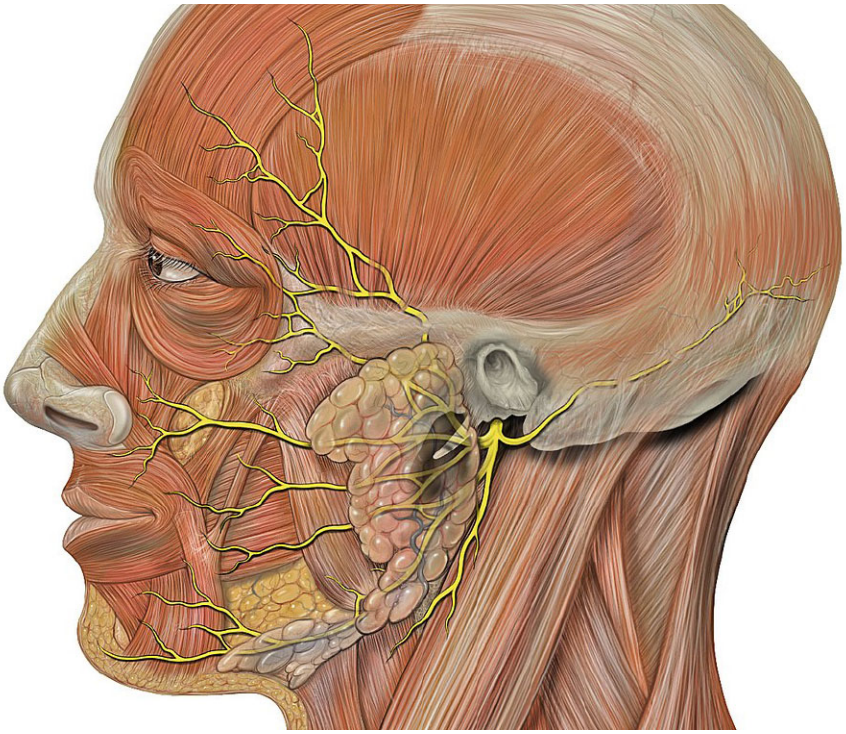


FIGURE 22.4 Nerve branches affecting the facial muscles. (credit: "Head facial nerve branches.jpg " by Patrick J. Lynch/Wikimedia Commons, CC BY 2.5)

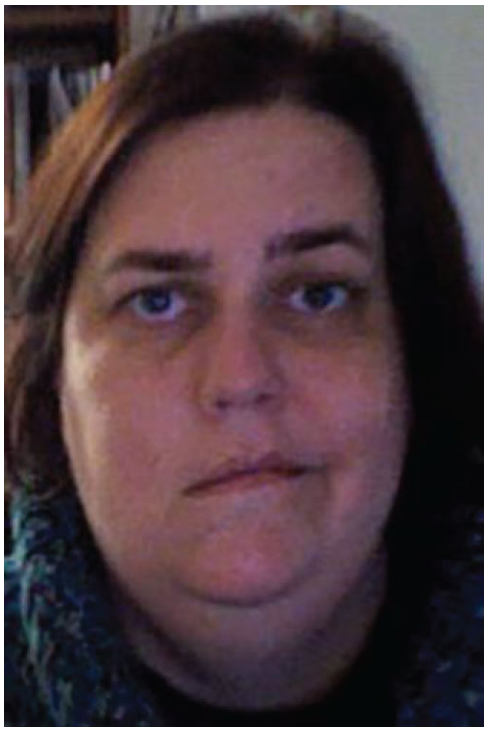


FIGURE 22.5 Facial droop, also known as ptosis, affecting the right side of the face. (credit: "Bell's Palsy smiling" by "Shantoo"/Wikimedia Commons, CC BY 1.0)

Neck

The neck is the region of the body that connects the head to the shoulders and the rest of the torso. It contains various structures, including muscles, vertebrae, blood vessels, thyroid gland, and lymph nodes. The neck is a vital region of the body that supports critical functions, including head movement, breathing, swallowing, communication, circulation, and immune responses.

Muscles and Cervical Vertebrae

The neck muscles are a group of muscles located in the region between the head and the shoulders (Figure 22.6). The neck muscles can be broadly categorized into these groups:

- **Anterior neck muscles:**
  - Sternocleidomastoid: The **sternocleidomastoid** muscle runs diagonally from the base of the skull behind the ear to the sternum and clavicle. It allows rotation and flexion of the head and neck.
  - **Scalene muscles:** The **scalene muscles** are located on the sides of the neck and assist in various neck movements as well as in breathing.
- **Posterior neck muscles:**
  - Trapezius: The **trapezius** is a large muscle that extends from the base of the skull down to the upper back. It helps stabilize and move the shoulder blades and supports head movements.
  - Levator scapulae: Located along the side of the neck, the **levator scapulae** muscle helps elevate the shoulder blades.
- **Lateral neck muscles:**
  - Sternocleidomastoid: While primarily located on the anterior neck, the sternocleidomastoid muscle also contributes to lateral neck movements.

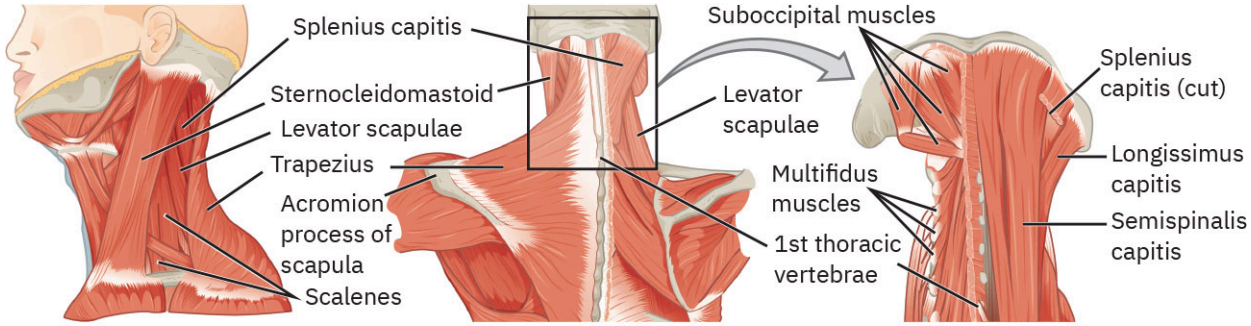


FIGURE 22.6 The neck muscles are a group of muscles located in the region between the head and the shoulders. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

These muscles are responsible for supporting and moving the head, facilitating breathing, and aiding in swallowing. The neck muscles contribute to maintaining good posture by supporting the head and upper body in an upright position and play a crucial role in allowing the head to move in different directions, including flexion (forward bending), extension (backward tilting), rotation (turning side to side), and lateral bending (tilting to the side). The neck muscles, especially the trapezius and levator scapulae, help stabilize the head, neck, and shoulders during various activities. Some neck muscles, particularly the scalene muscles, assist in the process of breathing by elevating the ribs during inhalation. Muscles in the neck work together to facilitate the swallowing process. They help move the larynx upward and forward to close off the airway while swallowing, preventing food or liquid from entering the trachea.

The **cervical vertebrae** consist of seven vertebrae that make up the upper part of the spine, forming the neck region. They are numbered C1 to C7, starting from the top, closest to the skull (Figure 22.7). Each cervical vertebra has specific anatomical features:

- Atlas (C1): The atlas is the first cervical vertebra that connects with the skull. It lacks a traditional vertebral body and instead has a ringlike structure that supports the skull's weight and allows nodding movements.
- Axis (C2): The axis is the second cervical vertebra and connects with the atlas. It has a unique bony projection called the odontoid process (dens), which allows the head to pivot for side-to-side movements.
- C3 to C7: These cervical vertebrae have similar structure, with vertebral bodies, neural arches, and processes. They gradually increase in size from C3 to C7.

The cervical vertebrae provide structural support for the head and protect the spinal cord, which passes through the vertebral canal formed by the stacked vertebrae. The unique structure of the atlas and axis allows for a significant

range of motion in the neck, enabling nodding and rotating movements. Cervical vertebrae serve as attachment points for various muscles, ligaments, and tendons involved in neck movement and stability.

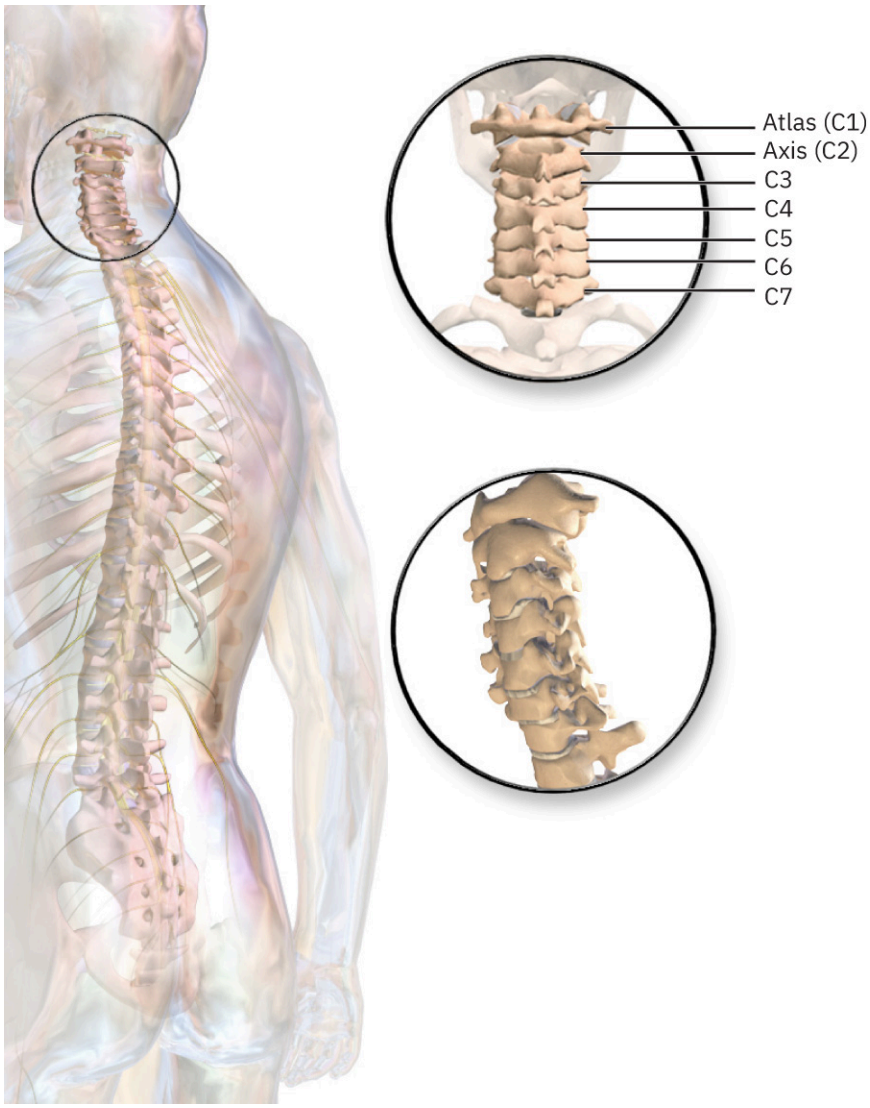


FIGURE 22.7 The cervical vertebrae consist of seven vertebrae that make up the neck region of the upper part of the spine. (credit: modification of work “Blausen 0222 CervicalSpine” by "BruceBlaus"/Wikimedia Commons, CC BY 3.0)

Blood Vessels

The neck contains several important blood vessels that supply blood to the brain, head, and other regions (Figure 22.8). These blood vessels include arteries, which carry oxygenated blood away from the heart, and veins, which return deoxygenated blood back to the heart. The major neck blood vessels include the following:

- Carotid arteries:
  - Common carotid arteries: There are two common carotid arteries, one on each side of the neck. They branch off from the aorta (the main artery leaving the heart) and supply oxygenated blood to the head and neck. The carotid arteries can be felt on both sides of the neck as strong pulses. The carotid pulse is often used to assess heart rate and rhythm.
  - Internal carotid arteries: These arteries further divide into smaller branches within the skull to supply blood to the brain.
  - External carotid arteries: These arteries supply blood to the face, scalp, and neck muscles.
- Jugular veins:
  - Internal jugular veins: Paired internal jugular veins drain deoxygenated blood from the brain, face, and neck muscles. The internal jugular veins are positioned deeper in the neck and are not visible or palpable

like the carotid arteries. They merge with the subclavian veins to form the brachiocephalic veins, which eventually lead to the superior vena cava, returning blood to the heart.

- External jugular veins: These veins drain deoxygenated blood from the scalp and face. The external jugular veins are more superficial and can be seen as prominent veins on the sides of the neck. They typically run superficially along the sides of the neck.

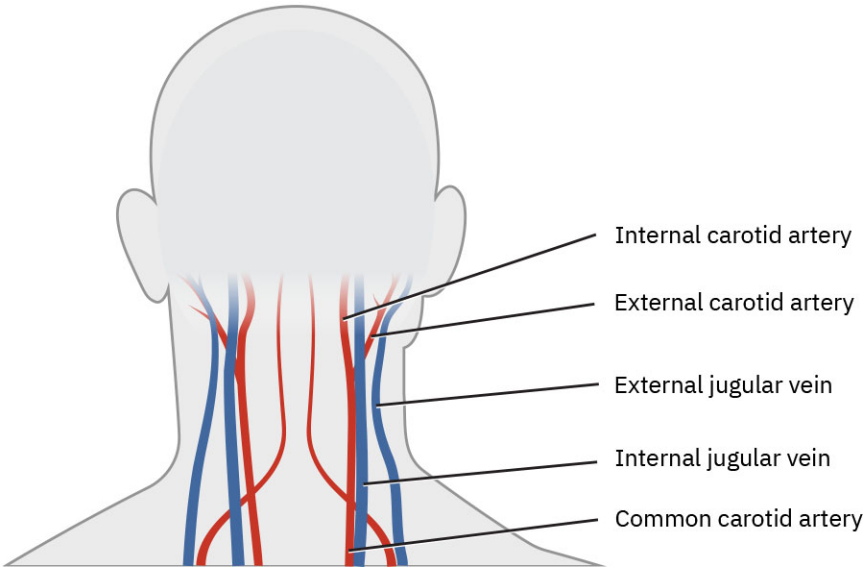


FIGURE 22.8 Location of the blood vessels found within the neck. (credit: modification of work “Circulatory System en” by "LadyofHats"/Mariana Ruiz Villarreal/Wikimedia Commons, Public Domain)

The carotid arteries play an important role in oxygen and nutrient delivery by supplying oxygenated blood rich in nutrients to the brain, face, scalp, and neck muscles. The internal carotid arteries play a critical role in delivering oxygen and nutrients to the brain, supporting its metabolic needs. Blood flow through the neck vessels helps regulate body temperature by distributing heat away from or toward the skin’s surface. Blood vessels also play a role in carrying waste products, such as carbon dioxide and metabolic by-products, away from tissues for elimination and contribute to maintaining proper fluid balance in tissues by transporting fluid between the bloodstream and surrounding tissues. In the event of reduced blood flow through one carotid artery due to disease or blockage, the other carotid artery can provide collateral circulation to the brain.

Thyroid Gland

Located in the front of the neck below the Adam’s apple and shaped like a butterfly, the **thyroid** gland is an endocrine gland consisting of two lobes on each side of the trachea connected by the isthmus, a narrow band of tissue. The thyroid gland’s structure is composed of small saclike structures called follicles, which contain thyroid cells that produce hormones.

The thyroid gland plays a crucial role in regulating metabolism—the process by which the body converts food into energy. It accomplishes this by producing two main hormones: thyroxine (T4) and triiodothyronine (T3). T3 and T4 help regulate the body’s basal metabolic rate, the rate at which the body uses energy for basic functions like breathing, digestion, and circulation. Other functions include producing energy by breaking down fats and carbohydrates, promoting proper brain development and bone growth, and regulating body temperature.

Lymph Nodes of the Head and Neck

The lymphatic system is the system of vessels, cells, and organs that carries excess interstitial fluid to the bloodstream and filters pathogens from the blood through lymph nodes found near the neck, armpits, chest, abdomen, and groin. See Figure 22.9 and Figure 22.10 for illustrations of the lymph nodes found in the head and neck regions. When a person is fighting off an infection, the lymph nodes in that region become enlarged, indicating an active immune response to infection.

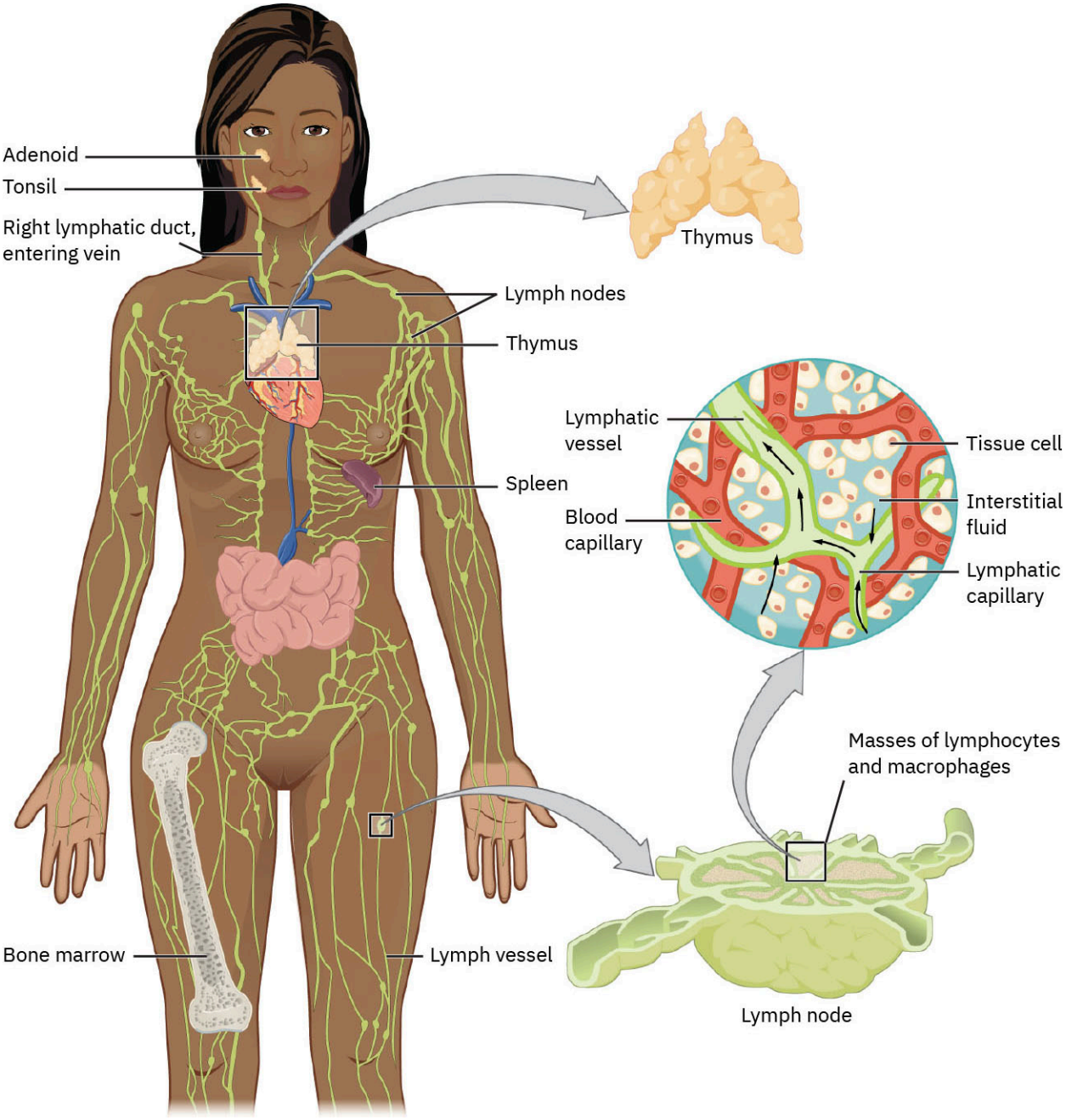


FIGURE 22.9 The lymphatic system maintains fluid balance, filters harmful substances, supports immune responses, and facilitates the transportation of nutrients and waste products. Its intricate network contributes to the body's ability to fight infections, heal injuries, and maintain a balanced internal environment. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

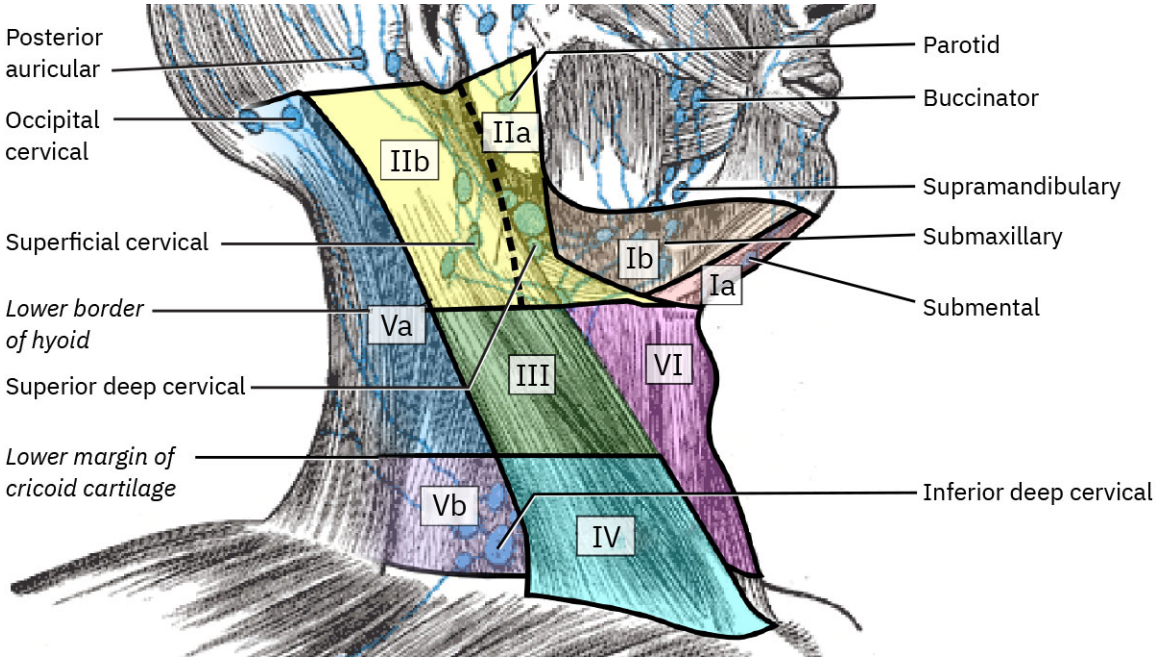


FIGURE 22.10 Lymph nodes found within the head and neck play a crucial role in filtering lymph and facilitating immune responses. They help trap and destroy harmful substances such as bacteria, viruses, and abnormal cells, contributing to the body's defense against infections and diseases. (credit: modification of work "Cervical lymph nodes and levels" by Mikael Häggström, M.D./Wikimedia Commons, Public Domain)

Nursing Assessment: Inspecting and Palpating the Head, Face, and Neck

During a nursing assessment, inspecting and palpating the head, face, and neck provide valuable insights into overall health. Observing for symmetry, skin conditions, and swelling, and gently palpating for tenderness or abnormalities, aid in detecting potential issues. A thorough assessment involves both subjective and objective data, as well as validating and documenting the assessment findings.

Subjective Data

Subjective data are self-reported experiences, feelings, and perceptions that cannot be directly measured. Begin the head and neck assessment by asking focused interview questions to determine whether the patient is currently experiencing any symptoms or has a previous medical history related to head and neck issues. Common interview questions to collect subjective assessment data of the head and neck can be found in Table 22.1.

Interview Questions	Follow-up
Have you ever been diagnosed with a medical condition related to your head such as headaches, concussion, stroke, or head injury?	If yes, please describe with details, such as what condition, when, frequency, symptoms, or medical treatment provided.
Have you ever been diagnosed with a medical condition related to your neck, such as a thyroid condition or enlarged lymph nodes?	If yes, please describe with details, such as what condition, when, symptoms, or medical treatment provided.

TABLE 22.1 Interview Questions for Subjective Assessment of the Head and Neck

Interview Questions	Follow-up
Are you currently taking any medications, herbs, or supplements for headaches or your thyroid?	If yes, please describe what you take, dose, frequency, route, and if it is effective.
Have you had any symptoms such as headaches, dizziness, neck pain or stiffness, or swollen lymph nodes?	If yes, use the PQRSTU method, or other pain assessment mnemonic, to gather additional information regarding each symptom such as (P)rovocative/Palliative factors, (Q)uality/Quantity, (R)egion/Radiation, (S)everity, (T)iming/Treatment, and (U)nderstanding.

TABLE 22.1 Interview Questions for Subjective Assessment of the Head and Neck

Objective Data

Objective data are measurable and observable data that can be assessed through examination, tests, or observations. During a head and neck assessment, inspection involves visually examining the external structures of the head and neck for any abnormalities, asymmetry, swelling, skin changes, or signs of underlying conditions. Use any information obtained during the subjective interview to guide your physical assessment.

Observe the patient's general appearance, noting their posture, facial expressions, and overall demeanor. Assess for signs of distress, discomfort, or unusual behavior. Examine the face for symmetry. Note any facial drooping, muscle weakness, or asymmetry that could indicate underlying neurological or muscular issues. Inspect the skin of the face, neck, and scalp for color, texture, and any lesions. Look for signs of rashes, bruising, moles, or lesions that may require further examination. Assess the eyes for any swelling, puffiness, or discoloration around the eyelids. Observe the position of the eyes and note any abnormalities in alignment. Check for any loss of hair from the eyebrows or eyelashes, which could indicate underlying conditions such as thyroid dysfunction. Assess the neck for symmetry, noting any visible masses, lumps, or swelling. Observe the trachea for proper midline alignment. Palpate gently for any enlarged or tender lymph nodes in the neck and behind the ears. Note their size, mobility, and tenderness. Examine the scalp for any lesions, lumps, or areas of tenderness. Check the hair for thickness, texture, and any signs of hair loss or bald patches. Observe the jaw's movement as the patient opens and closes their mouth. Note any clicking, popping, or pain in the temporomandibular joint area in the jaw.

CULTURAL CONTEXT

Cultural Sensitivity before Physical Assessment

In many Asian cultures, the head is considered a sacred and spiritually significant part of the body. As a result, touching someone's head without proper cultural context or permission can be seen as disrespectful or offensive. It is best practice to ask permission prior to touching someone's head.

Validating and Documenting Findings

Validating and documenting assessment findings of the head and neck are essential steps in the nursing process to ensure accurate communication and informed decision-making. Subjective and objective findings should be cross-referenced to ensure the data collected are reliable and accurate. Data may be validated by repeating the assessment, asking additional questions to clarify data, and comparing the objective findings with the subjective findings to determine if any discrepancies are present. For example, additional assessment and questioning may be warranted if the patient reports not having a headache, yet they are holding their head with eyes squinted.

Documentation provides a clear record of the patient's condition for future reference and collaboration among healthcare providers. Documentation should include both subjective and objective data. Subjective data may include findings such as: "Patient reports headache lasting five days," "Patient reports headache rated 7/10 using the numerical pain scale," or "Patient reports falling down the stairs and hitting their head." When documenting subjective data, include direct quotes when possible. For example, document "Patient complains of headache that feels like someone is 'squeezing their head' for the past two days." Objective data are collected through the physical

assessment. Examples of documentation for objective data may include findings such as: “Trachea is midline,” “Face is symmetrical, no swelling or facial droop observed,” “Palpable lymph node behind left ear with tenderness noted,” or “Hair is thin and brittle with moderate hair loss noted.”

Abnormalities of the Head and Neck

When conducting a health assessment, it is important to be able to recognize abnormalities of the head and neck. These abnormalities can range from minor cosmetic differences to more serious medical conditions. Identifying abnormalities allows healthcare professionals to detect potential issues early, enabling timely intervention and treatment. While there are many abnormalities that may be seen during the head and neck assessment, this section reviews the most common abnormalities.

Headache

A **headache** is a common and uncomfortable sensation of pain or discomfort in the head or upper neck area. Headaches range greatly in severity of pain and frequency of occurrence. For example, some patients experience mild headaches once or twice a year, whereas others experience disabling migraine headaches on a monthly basis. Severe headaches, such as migraines, may be accompanied by symptoms of nausea or increased sensitivity to noise or light. Primary headaches occur independently and are not caused by another medical condition. Migraine, cluster (intense headaches for several weeks, followed by periods of remission), and tension-type headaches (described as a constant bandlike pressure around the head) are types of primary headaches. Secondary headaches are symptoms of another health disorder that causes pain-sensitive nerve endings to be pressed on or pulled out of place. An example of a secondary headache may be a sinus headache in which inflammation and congestion of the nasal passages result in pain in the forehead and around the eyes. Headaches are caused by factors such as stress, tension, hormonal changes (common in migraines), dehydration, lack of sleep or poor sleep quality, certain foods or drinks (like caffeine or alcohol), environmental factors (loud noise, bright lights), sinus infections, allergies, dental problems, hypertension, head injury or trauma, fever, and infection. A description of the different types of headaches can be found in Table 22.2.

Type of Headache	Description	Additional Information	Location
Primary Headaches			
Tension	Dull; aching sensation; tenderness or sensitivity around the neck, forehead, scalp, or shoulder muscles	Often triggered by stress	Tension headache (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

TABLE 22.2 Types of Headaches

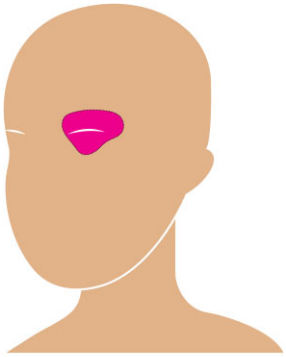
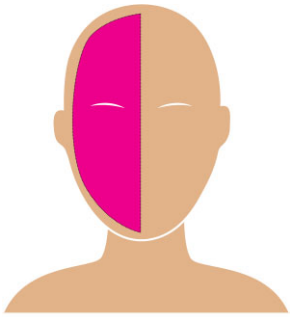
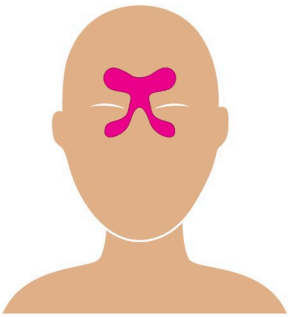
Type of Headache	Description	Additional Information	Location
Cluster	Severe burning and piercing pain occurring around or behind one eye or on one side of the face	A series of headaches that reoccur over days or weeks	 Cluster headache (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Migraine	Intense pulsing pain deep in the head, throbbing pain usually on one side of the head, may cause light and sound sensitivity, may cause nausea and vomiting	May be triggered by sleep disruption, dehydration, some foods, hormone fluctuations, exposure to chemicals	 Migraine headache (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
		Secondary Headaches	
Allergy or sinus	Pain in the sinus area and frontal portion of the head	Common in those with chronic seasonal allergies or sinusitis	 Allergy headache (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

TABLE 22.2 Types of Headaches

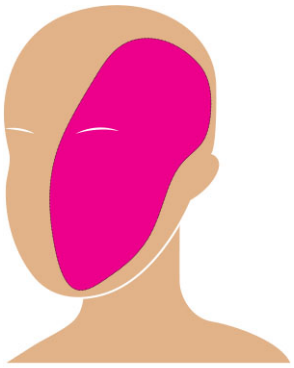
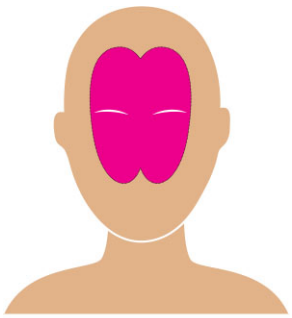
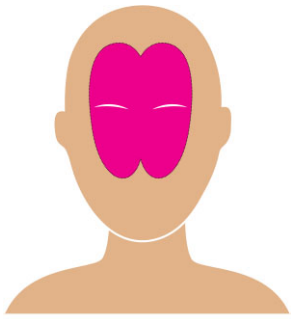
Type of Headache	Description	Additional Information	Location
Hormone	Throbbing pain that starts on one side of the head, may also involve sensitivity to light and nausea or vomiting	Headache linked to hormonal fluctuations, such as those who menstruate, use birth control, or are pregnant	 Hormonal headache (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Caffeine	Pain and pressure that started behind the eyes and pushes outward from the brain	Associated with too much caffeine or abruptly quitting caffeine	 Caffeine headache (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Exertion	Throbbing on both sides of the head, resolves in minutes to hours	Occur after periods of intense physical activity, such as weightlifting and running	 Exertion headache (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

TABLE 22.2 **Types of Headaches**

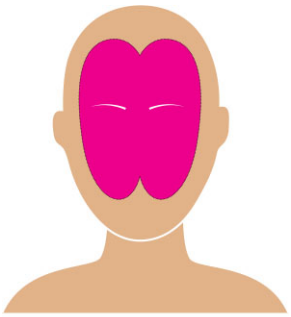
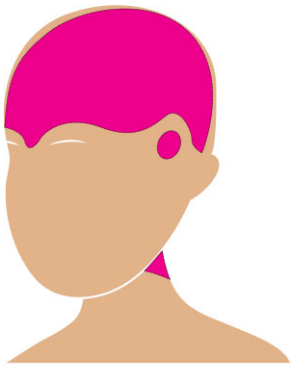
Type of Headache	Description	Additional Information	Location
Hypertension	Usually occurs on both sides of the head and is typically worse with any activity, often described as pulsating	Medical emergency signaling dangerously high blood pressure (usually greater than 180/120 mm Hg)	 Hypertension headache (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Spinal	Pain in the forehead, temples, upper neck, and back of the head	Results from low cerebrospinal fluid pressure following a lumbar puncture	 Spinal headache (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

TABLE 22.2 Types of Headaches

Not all headaches require medical attention, but some types of headaches can signify a serious disorder and require prompt medical care. Symptoms of headaches that require immediate medical attention include a sudden, severe headache unlike any the patient has ever had; a sudden headache associated with a stiff neck; a headache associated with convulsions, confusion, or loss of consciousness; a headache following a blow to the head; or a persistent headache in a person who was previously headache free.

Concussion

A **concussion** is a type of **traumatic brain injury (TBI)** that occurs when the brain experiences a sudden and forceful movement within the skull. This movement can result from a blow, bump, jolt, or any impact to the head or body that causes the brain to shake inside the skull. Concussions are commonly caused by accidents, falls, sports-related injuries, or any situation where the head or body experiences a rapid deceleration or acceleration; however, they can also occur from something as simple as running into a glass door.

Symptoms of a concussion include headache or pressure in the head, confusion or feeling dazed, temporary loss of consciousness, memory problems or difficulty concentrating, dizziness or balance issues, nausea or vomiting, sensitivity to light or noise, mood changes, irritability, and blurred vision. If any of these symptoms are present after a head injury, it is important to seek medical attention right away. Diagnostics may involve assessing the individual's symptoms, performing a neurological examination, and consulting imaging tests (such as a computed tomography

[CT] scan or magnetic resonance imaging [MRI]) to rule out more serious injuries. Treatment for concussions typically involves rest (both physical and cognitive), avoiding activities that could worsen symptoms (such as reading or screen time), gradually returning to activity, and closely monitoring the patient to ensure symptoms are improving and not worsening.

Head Injury

A head injury refers to any trauma or damage that occurs to the head, scalp, skull, or brain. Head injuries can range from minor bumps and bruises to more serious conditions like concussions or traumatic brain injury (TBI) (damage to the brain caused by a sudden, external force or trauma). Strong blows to the brain case of the skull can produce fractures resulting in bleeding inside the skull. A blow to the lateral side of the head may fracture the bones of the pterion. If the underlying artery is damaged, bleeding can cause the formation of a hematoma (collection of blood) between the brain and interior of the skull. As blood accumulates, it will put pressure on the brain. Symptoms associated with a hematoma may not be apparent immediately following the injury, but if untreated, blood accumulation will continue to exert increasing pressure on the brain and can result in death within a few hours.

If a head injury occurs, check for responsiveness and breathing. If the person is unconscious or having difficulty breathing, call for emergency medical help. If there is bleeding, apply gentle pressure with a clean cloth to stop it. Avoid pressing directly on the injury site if a skull fracture is suspected. If a head or neck injury is suspected, avoid moving the person's head or neck until medical professionals arrive. Even seemingly minor head injuries should be evaluated by a healthcare professional, as symptoms can worsen over time. Some head injuries can have delayed symptoms, so monitoring for changes in behavior, consciousness, or symptoms is crucial.

Acromegaly

A rare hormonal disorder termed **acromegaly** occurs when the pituitary gland, located at the base of the brain, produces an excessive amount of growth hormone (GH). Typically, the cause of the excessive GH is due to a noncancerous tumor in the pituitary gland called an **adenoma**. This excess GH leads to the enlargement and overgrowth of certain body tissues, primarily bones and soft tissues in the hands, feet, face, and internal organs. Acromegaly usually develops slowly over time and becomes more noticeable with advanced age. Common signs and symptoms of acromegaly include enlarged hands and feet, gradual changes in facial features (such as a prominent forehead, enlarged nose, protruding jaw, and gaps between teeth), skin changes (such as thick, oily skin; skin tags; or excessive sweating); enlarged internal organs (such as the heart, liver, and kidneys), joint pain, deepened voice, carpal tunnel syndrome, tiredness and weakness, headaches, vision problems, and sleep apnea. Acromegaly is often diagnosed through a combination of physical examination, medical history review, blood tests to measure GH and insulin-like growth factor-1 (IGF-1) levels, and imaging studies like MRI or CT scans to identify if a pituitary adenoma is present.

Early diagnosis and treatment are important to prevent the symptoms from getting worse and reduce the chance of complications. Treatment options for acromegaly typically involve addressing the underlying cause, which is usually the pituitary adenoma. Treatment methods include surgery to remove the adenoma; medications such as somatostatin analogs (e.g., octreotide, lanreotide) and GH receptor antagonists (e.g., pegvisomant) to help control GH levels and alleviate symptoms; and radiation. Regular follow-up with medical professionals, including endocrinologists and specialists in pituitary disorders, is important for long-term management.

Cushing Syndrome

Cushing syndrome, also known as **hypercortisolism**, is characterized by an excessive and prolonged exposure to high levels of the hormone cortisol. Cortisol is produced by the adrenal glands, which are located on top of each kidney, and plays a vital role in regulating various bodily functions such as metabolism, immune response, and blood pressure. Common signs and symptoms of Cushing syndrome include weight gain, a round face, increased fat around the base of the neck, a fatty hump between the shoulders, thin arms and legs, muscle weakness and atrophy, easy bruising, slowed wound healing, stretch marks, high blood pressure, osteoporosis, mood swings, depression, glucose intolerance, increased hair growth, and irregular menstrual cycles (Figure 22.11).

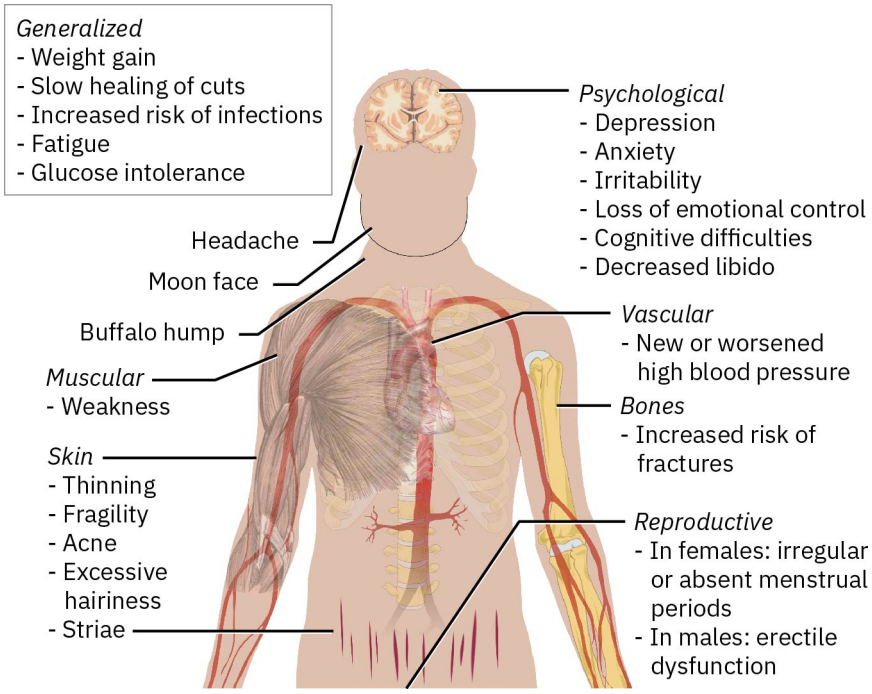


FIGURE 22.11 Signs and symptoms of Cushing syndrome. (credit: modification of work "Cushing's syndrome (vector image).svg" by Mikael Häggström/Wikimedia Commons, Public Domain)

The most common cause of Cushing syndrome is long-term use of high-dose cortisol, such as glucocorticoids and corticosteroids. Other times, people develop endogenous Cushing syndrome because their bodies make too much cortisol. Additionally, several types of tumors can cause the body to make excess cortisol, such as adrenal tumors and ectopic ACTH-producing tumors.

Diagnosis of Cushing syndrome involves a combination of clinical evaluation, hormone tests to measure cortisol and ACTH levels, and imaging studies like MRI or CT scans to identify potential tumors in the adrenal glands or pituitary gland. If a tumor is identified, its removal may be considered as a treatment option. Other treatment options may include cortisol-lowering medications or gradual steroid reduction. The goal of treatment is to normalize cortisol levels and alleviate the symptoms associated with Cushing syndrome.

Scleroderma

The chronic, autoimmune disorder **scleroderma (also, systemic sclerosis)** causes inflammation in the skin and can also affect various internal organs such as the heart, lungs, and bowels. A hallmark sign of scleroderma is the abnormal accumulation of collagen, a protein that forms the connective tissues in the body, formed by the immune system tricking the body into thinking it is injured, which leads to inflammation and subsequent collagen formation. This excessive collagen production leads to thickening, hardening, and tightening of the skin and connective tissues, as well as potential damage to organs.

Scleroderma affects many body systems. It can be categorized as a connective tissue disease, an autoimmune disease, and a rheumatic disease. A **connective tissue disease** affects tissues such as skin, tendons, and cartilage. An **autoimmune disease** occurs when the body attacks its own tissues. A **rheumatic disease** leads to inflammation and/or pain in the muscles, joints, or fibrous tissue.

Scleroderma can be classified as localized or systemic. Localized scleroderma affects the skin and underlying tissues. It results in patches of scleroderma, known as **morphea**, or a line of scleroderma that runs down the arm, leg, forehead, or face, known as **linear scleroderma** (Figure 22.12).

FIGURE 22.12 Scleroderma may present in patches (morphea) or lines (linear), as seen here. (credit: "En coup de sabre lesion" by National Library of Medicine, CC BY 2.0)

Systemic scleroderma affects the skin, blood vessels, and major organs. There are two main types of systemic scleroderma, limited or diffuse, depending on the degree of skin involvement. Limited scleroderma comes on gradually and typically involves the skin of the face, hands, and feet. It often begins with **Raynaud phenomenon** (Figure 22.13), which is characterized by the fingers and toes turning white or blue in response to cold temperatures or stress. Other symptoms can include skin thickening, difficulty swallowing, and mild lung and heart issues. Calcium deposits can form under the skin, particularly at the fingertips, causing bumps that can be seen on x-rays. Some people also experience telangiectasia, a condition caused by the swelling of blood vessels, which results in small red spots on their hands and face. Diffuse scleroderma affects a larger area of the skin, expanding above the knees and elbows, and can progress more rapidly. It can also involve internal organs such as the lungs, heart, kidneys, and digestive system. Scarring of the lung and heart tissues may lead to shortness of breath, hypertension, irregular heart rate, and congestive heart failure. Sudden increases in blood pressure may cause kidney crisis, which can lead to sudden kidney failure if prompt treatment is not provided. Digestive problems may lead to heartburn, difficulty swallowing, bloating, diarrhea, constipation, and fecal incontinence. In addition, individuals with systemic scleroderma often experience joint pain, restricted movement, muscle weakness, and fatigue.

FIGURE 22.13 Raynaud phenomenon causes the fingers to turn white or blue due to reduced blood flow. (credit: "Raynaud's phenomenon 1" by "knotimpressed"/Wikimedia Commons, CC BY 1.0)

Anyone can get scleroderma, but there are several genetic and environmental factors associated with the condition. Although not an inheritable condition, those with a first-degree relative with scleroderma are at a higher risk of developing the condition. Women are more likely to develop scleroderma than men, most likely due to hormonal differences. Additional factors include abnormal immune or inflammatory conditions as well as exposure to viruses and chemicals.

There is no known cure for scleroderma. Treatment of the condition focuses on managing symptoms, preventing complications, and improving quality of life. Medications, physical therapy, and lifestyle modifications can help control symptoms and slow disease progression. In severe cases where internal organs are significantly affected, organ-specific treatments may be necessary. Regular medical monitoring is crucial for individuals with scleroderma to catch and manage any potential organ complications early. A multidisciplinary approach involving rheumatologists, dermatologists, pulmonologists, and other specialists is often needed to provide comprehensive care.

Bell Palsy

Bell palsy is a neurological disorder characterized by the sudden onset of facial muscle weakness or paralysis (Figure 22.14). It is considered a form of temporary facial nerve dysfunction (also known as the seventh cranial nerve) that leads to the inability to control facial muscles. Symptoms of Bell palsy can develop rapidly, often within forty-eight to seventy-two hours and may include sudden weakness or paralysis on one side of the face, drooping of the mouth and eyelid, drooling from one side of the mouth, and difficulty closing the eyelid. Typically, Bell palsy affects one side of the face, though there are rare occasions when both sides of the face may be impacted.

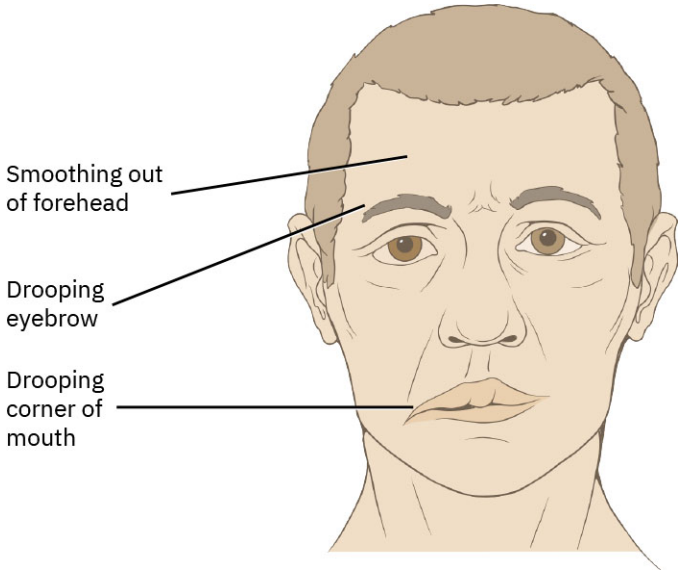


FIGURE 22.14 Bell palsy causes paralysis on one side of the face. (credit: modification of work "Bells palsy diagram" by Patrick J. Lynch/ Wikimedia Commons, CC BY 2.5)

In most cases, Bell palsy is a self-limiting condition and improves over a period of weeks to a few months. The majority of people experience near-complete recovery of facial muscle function, though some may experience permanent facial weakness. Individuals with Bell palsy may subsequently develop a loss of taste on the front two-thirds of the tongue, increased sensitivity to sound in one ear, dry eye or excessive tearing, altered speech (such as difficulty pronouncing certain words), facial pain or abnormal sensations, as well as pain around the jaw and behind the ear.

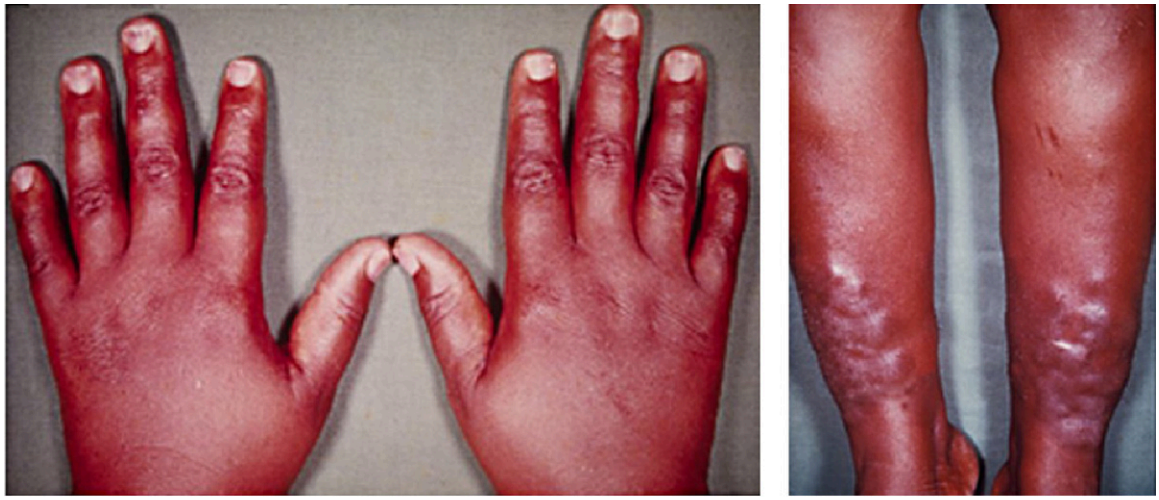
The exact cause of Bell palsy is not definitively understood; however, it is believed to be related to inflammation and swelling of the facial nerve, often triggered by a viral infection, commonly the herpes simplex virus (the same virus responsible for cold sores). Other factors that might contribute to the development of Bell palsy include pregnancy, preeclampsia, obesity, hypertension, diabetes, stress, sleep deprivation, and autoimmune disorders.

Diagnosis is made by examining the symptoms and ruling out other causes of facial weakness, such as stroke or brain tumor. While there is no lab test to diagnose Bell palsy, tests may be conducted to assess nerve damage and to determine the possible underlying cause of developing the disorder. For example, electromyography (EMG) can assess electrical activity to determine severity and extent of nerve damage. MRI or CT can assess the nerves and rule out structural causes of nerve damage. Blood tests can be used to diagnose and assess contributing factors, such as diabetes and infections.

Treatment of Bell palsy primarily focuses on supportive measures and management of symptoms. Medication therapy may include administering steroid medications within seventy-two hours of symptom onset to reduce inflammation and speed up the recovery process, antiviral agents, and over-the-counter analgesics, such as aspirin, acetaminophen, or ibuprofen. To prevent complications related to the inability to close the affected eye, artificial tears or eye patches may be used. In severe cases, taping the eye shut during sleep might be recommended. Physical therapy, facial exercises, massage, acupuncture, and electrical stimulation can help maintain muscle tone and promote better recovery. Though rare, surgical interventions may be warranted to correct facial damage.

Myxedema

The term **myxedema** is used to describe a severe form of hypothyroidism that occurs when the thyroid gland does not produce enough thyroid hormones. It is characterized by the accumulation of a substance called mucin in the skin and other tissues. This leads to characteristic symptoms such as swelling and puffiness in various parts of the body, particularly around the eyes, face, hands, and feet; skin that may appear thickened, swollen, dry, rough, and "waxy"; hair that may become thin, brittle, and dry; nails that may become brittle and slow-growing; as well as hoarseness in the voice (Figure 22.15). Other symptoms may include cold intolerance, fatigue and weakness, memory problems, difficulty concentrating, slowed thinking, depression, and constipation.



(a) (b)

FIGURE 22.15 These photos highlight the characteristic symptoms of myxedema, a severe form of hypothyroidism. The puffiness around the eyes, (a) thick and dry skin, brittle hair, and (b) overall swelling are hallmark indicators of this condition. (credit: modification of work "Myxedema" by Herbert L. Fred, MD, and Hendrik A. van Dijk/Wikimedia Commons, CC BY 2.0)

Treatment for myxedema involves replacing the deficient thyroid hormones through medication, typically with synthetic thyroid hormones like levothyroxine. The goal is to restore thyroid hormone levels to normal and alleviate the associated symptoms. Regular monitoring and management are essential to ensure the effectiveness of treatment and to prevent complications. Myxedema is a medical emergency when it becomes severe, leading to a condition called myxedema coma. Myxedema coma is characterized by extreme lethargy, confusion, hypothermia, low blood pressure, and other life-threatening complications. It requires immediate medical attention and intensive care.

Simple Goiter

A **simple goiter (also, endemic goiter)**, is a noncancerous enlargement of the thyroid gland that results in visible swelling of the neck (Figure 22.16). It occurs when the thyroid gland becomes larger than normal, leading to a noticeable lump or protrusion in the front of the neck. This condition is usually caused by an insufficient intake of iodine, a trace mineral that is essential for the production of thyroid hormones. If a person's diet lacks sufficient iodine, the thyroid gland may not be able to produce enough thyroid hormones, leading to an increase in thyroid-stimulating hormone production. Thyroid-stimulating hormone stimulates the thyroid gland to grow in an attempt to produce more thyroid hormones, resulting in the enlargement of the thyroid gland and the development of a goiter.

FIGURE 22.16 A simple goiter is an abnormality that causes visible swelling in the neck. (credit: "Goiter" by Jerry Kirkhart/Flickr, CC BY 2.0)

While simple goiters are generally benign and not associated with cancer, they can cause discomfort or aesthetic concerns due to the visible swelling in the neck. Additionally, if left untreated, they may lead to complications such as difficulty breathing or swallowing, or in some cases, changes in thyroid hormone levels that affect overall health. Treatment for a simple goiter typically involves addressing the underlying iodine deficiency. In many cases, the enlargement of the thyroid gland can be reversed with adequate intake of iodine through iodized salt or other dietary sources rich in iodine.

22.2 Eyes

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Analyze the structure and function of the eyes
- Understand how to perform a nursing assessment of the eyes
- Recall common abnormalities of the eye

The nursing assessment of the eye plays a pivotal role in ensuring the overall health and well-being of individuals. The eyes are not only vital for vision but also serve as windows to the body's general health. Through careful observation, evaluation, and documentation, nurses can uncover potential issues, monitor the progression of existing conditions, and contribute to timely interventions. Whether assessing visual acuity, examining the external and internal structures of the eye, or addressing specific concerns, the nursing assessment of the eye is a fundamental component of comprehensive patient care.

Structure and Function of the Eyes

Located within the orbit of the skill, the eye is a complex and intricate organ responsible for receiving visual information from the surrounding environment and transmitting it to the brain for interpretation. Its various structures work together to allow us to see and perceive the world around us (Figure 22.17).

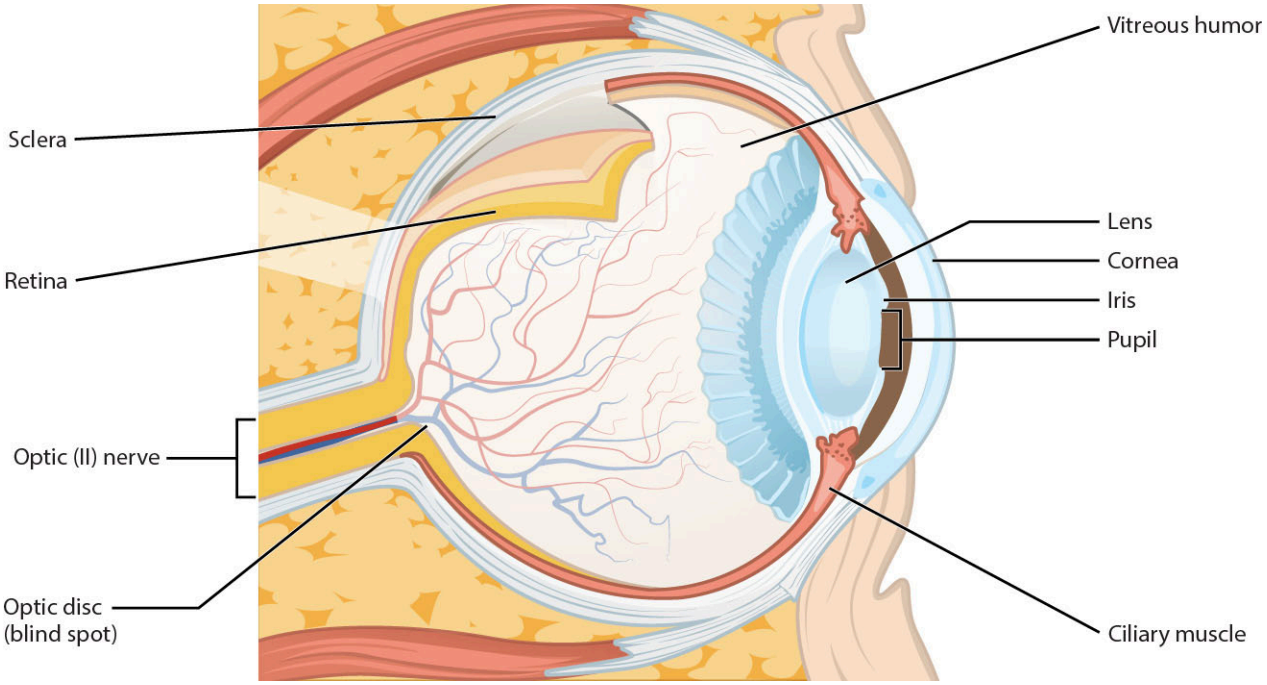


FIGURE 22.17 The eye is composed of both external and internal structures that work together to enable vision. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

External Structures

External structures of the eye consist of the following:

- Eyebrow: The **eyebrow** is the hair-covered ridge above the eye that helps protect the eye from sweat and direct sunlight.
- Eyelid: The **eyelid** is the movable fold of skin and muscle that covers and protects the front of the eye.
- Eyelashes: The **eyelashes** are short hairs along the eyelid edges that help prevent debris from entering the eye.
- Conjunctiva: The **conjunctiva** is a thin, transparent membrane covering the front surface of the eye (except the cornea) and the inner surface of the eyelids.
- Cornea: The **cornea** is the clear, dome-shaped front surface of the eye that focuses light onto the lens and retina.
- Sclera: The **sclera** is the white, tough outer covering of the eye that helps maintain its shape and protect its inner structures.
- Iris: The **iris** is the colored part of the eye that controls the size of the pupil and regulates the amount of light entering the eye.
- Pupil: The **pupil** is the black circular opening in the center of the iris that allows light to enter the eye.
- Lacrimal gland: The **lacrimal gland** produces tears that keep the eye moist and help with lubrication, nourishment, and protection against infections.
- Lacrimal ducts: The **lacrimal duct** drains tears from the eye's surface to the nasal cavity.

Internal Structures

Internal structures of the eye consist of the following:

- Lens: The **lens** is a transparent, flexible structure located behind the iris. It changes shape to focus light onto the retina.
- Ciliary muscle: The **ciliary muscle** controls the shape of the lens to help with focusing on near and distant objects (accommodation).
- Vitreous humor: The **vitreous humor** is a gel-like substance that fills the larger space within the eye, helping maintain its shape and providing support to the retina.
- Retina: The **retina** is the innermost layer of the eye that contains specialized cells called photoreceptors (rods and cones) that detect light and transmit visual signals to the brain.

- Cones: A **cone** is a photoreceptor that is primarily responsible for color vision and visual acuity (sharpness).
- Rods: A **rod** is a photoreceptor that is responsible for vision in low-light conditions and for detecting movement.
- Macula: The **macula** is the small, central area of the retina responsible for central vision and color perception.
- Optic nerve: The **optic nerve** is a bundle of nerve fibers that carries visual information from the retina to the brain for processing.
- Optic disc: The **optic disc** is the area where the optic nerve exits the retina; it lacks photoreceptors, creating the "blind spot."

Movement of the eye within the orbit occurs by the contraction of six extraocular muscles that originate from the bones of the orbit and insert into the surface of the eyeball. The extraocular muscles are innervated by the abducens nerve, trochlear nerve, and oculomotor nerve (cranial nerves III, IV, and V).

Vision

The process of vision is a complex and intricate interaction involving various structures within the eyes, brain, and neural pathways. From the visual fields that encompass our surroundings to the intricate neural pathways that relay information to the brain, and to the reflexes that adapt our visual experience to changing conditions, each facet of this process contributes to our profound sense of sight. Key elements of vision include visual fields, visual pathways, and visual reflexes.

Visual Fields and Visual Pathways

A **visual field** refers to the entire area that an individual can see when their gaze is fixed straight ahead. It includes all the objects and surroundings that can be perceived without moving the eyes. The visual field can be divided into two main parts for each eye: the central visual field and the peripheral visual field. The central visual field is the portion of the visual field that corresponds to the area around the point where you are directly looking. It provides the sharpest and most detailed vision and is critical for activities like reading, recognizing faces, and focusing on specific objects. The peripheral visual field encompasses the outer edges of the visual field. While it does not provide the same level of detail as the central visual field, it plays a crucial role in detecting motion, objects, and changes in the environment. It is especially important for spatial awareness and detecting potential threats from the sides.

A visual pathway is a complex network of neural connections that carries visual information from the eyes to the brain, where it is processed and interpreted to create visual perceptions. The visual pathway involves a series of structures and connections that work together to transmit visual signals and transform them into meaningful visual experiences. The process begins in the retina, where specialized cells called photoreceptors (rods and cones) detect light and convert it into electrical signals. The electrical signals generated by the photoreceptors travel along the optic nerves. These nerves carry the visual information toward the brain. Upon reaching the optic chiasm, which is located at the base of the brain, some of the nerve fibers from each optic nerve cross over to the opposite side, which allows information from both eyes to be combined and integrated. The nerve fibers that have crossed over at the optic chiasm continue as optic tracts, which carry the visual information further into the brain. The optic tracts connect to the lateral geniculate nucleus (LGN), a structure in the thalamus (a part of the brain) that processes and relays the visual signals to the visual cortex. The visual cortex, located in the occipital lobe at the back of the brain, receives and processes the visual information sent by the LGN. Different areas of the visual cortex specialize in analyzing different aspects of visual perception, such as color, shape, and motion. The visual cortex integrates and interprets the incoming visual signals to create the visual perceptions that are experienced.

Visual Reflexes

A **visual reflex** is an automatic and involuntary response of the eyes and the body to visual stimuli. These reflexes play a crucial role in maintaining visual stability, protecting the eyes, and optimizing visual perception. Important visual reflexes include the following:

- Pupillary reflex: Pupils constrict in bright light or dilate in dark spaces to regulate the amount of light entering the eye. This reflex is controlled by the interaction between the iris and the brain's visual centers.
- Accommodation reflex: When looking at objects at varying distances, the eyes automatically adjust the shape of the lens to focus the image clearly on the retina to ensure objects at different distances remain in focus.
- Convergence reflex: When an object moves closer to the eyes, the eyes turn inward (converge) to keep the

object in focus.

- Optokinetic reflex: When presented with a moving visual stimulus, such as a rotating drum with stripes, the eyes move in the direction of the stimulus and then reset to the initial position. This reflex helps stabilize vision during continuous movement.
- Vestibulo-ocular reflex: This reflex coordinates eye movements with head movements to maintain stable vision while the head is in motion. When the head moves, the eyes move in the opposite direction to counteract the movement and keep the visual scene steady.
- Blink reflex: When an object approaches the eyes suddenly, such as a foreign object or an unexpected movement, the eyelids automatically close (blink) to protect the eyes from potential harm.
- Gaze fixation reflex: When focusing on a stationary object, the eyes make small involuntary movements that prevent visual adaptation and help maintain a clear image on the retina.
- Optical righting reflex: When the body's orientation changes, such as when tilting the head, the eyes automatically adjust their position to align with the new gravitational reference.
- Near response reflex: When looking at a nearby object, the eyes converge to bring the object into focus and the pupils constrict. This reflex is part of the accommodation-convergence reflex loop.

Visual reflexes ensure that the eyes continuously adapt to changes in the visual environment and maintain optimal visual function. These reflexes are mediated by complex neural pathways and involve interactions between the eyes, the brain's visual centers, and other sensory systems like the vestibular system (which controls balance and spatial orientation).

Nursing Assessment: Inspecting the Eyes

Inspecting the eyes is a fundamental component of the nursing assessment, allowing healthcare providers to gather valuable information about a person's ocular health and overall well-being. This assessment involves careful observation and examination of the eyes and their surrounding structures. Through this process, nurses can identify potential abnormalities, monitor changes in visual health, and contribute to timely interventions. Whether assessing the external appearance of the eyes, eyelids, or conjunctiva, or observing pupil reactions and eye movements, this comprehensive examination offers crucial insights into a patient's visual status.

Assessing the Pupils

Inspecting the pupils is an important part of a nursing assessment, as it can provide valuable information about a person's neurological and ophthalmic health. To assess the pupils, ensure proper lighting in the room (dim lighting can help with assessing pupil size). Wash your hands and don gloves. Explain the procedure to the patient to ensure their cooperation and comfort. Position the patient comfortably sitting or lying down, facing you.

Begin by assessing the patient's overall level of alertness and consciousness. A patient who is not fully alert may have different pupil responses. Ask the patient to look straight ahead, keeping their gaze focused on a distant object. Hold the penlight or flashlight about 12 to 15 inches away from the patient's face and shine the light directly into one eye. Observe both pupils for their initial size and equality. They should be of equal size and react similarly to light. On average, a normal adult pupil is approximately 2 to 4 millimeters in bright lights and 4 to 8 millimeters in dark spaces. Note any differences in size between the two pupils. Test the pupil's reaction to light by shining the light directly into one pupil and observing the response. The illuminated pupil should constrict briskly, and the opposite pupil should also constrict when light is shone into the other eye. If one or both pupils do not constrict or if the response is sluggish, it may indicate an abnormality in the neurological or ophthalmic system.

To test pupil accommodation, ask the patient to focus on a near object (e.g., your finger) and then switch their focus to a distant object. Observe the pupils for changes in size. The pupils should constrict when focusing on a near object and dilate when focusing on a distant object. If the pupils do not react as expected during accommodation, it may indicate a dysfunction in the pupil's response to changes in focus.

LINK TO LEARNING

Watch a demonstration of how to check pupil reflexes (https://openstax.org/r/77PupilRefCheck) in this video.

Visual Acuity

Assessing visual acuity is a crucial aspect of a comprehensive eye examination. The **visual acuity** measures a person's ability to see details at a specific distance. Visual acuity includes both far and near vision assessments.

To assess far-distance vision, ensure the room is well lit and the patient is wearing any corrective lenses they normally use (glasses or contact lenses). Explain to the patient they will be asked to read letters or symbols on a chart to assess their ability to see details. Far-distance acuity is measured using the Snellen chart (Figure 22.18) at a distance of 20 feet (6 meters) in the United States. The Snellen chart consists of rows of letters or symbols, with the largest and most visible letters at the top and progressively smaller ones below. Instruct the patient to cover one eye and read the letters from the top row to the bottom until they can no longer correctly identify the letters or symbols. Visual acuity is recorded as a fraction. The top number represents the distance at which the chart is viewed (20 feet), and the bottom number indicates the distance at which a person with normal vision can read the line. For example, if the patient can read the line labeled "20/40," it means they can see at 20 feet what a person with normal vision can see at 40 feet.

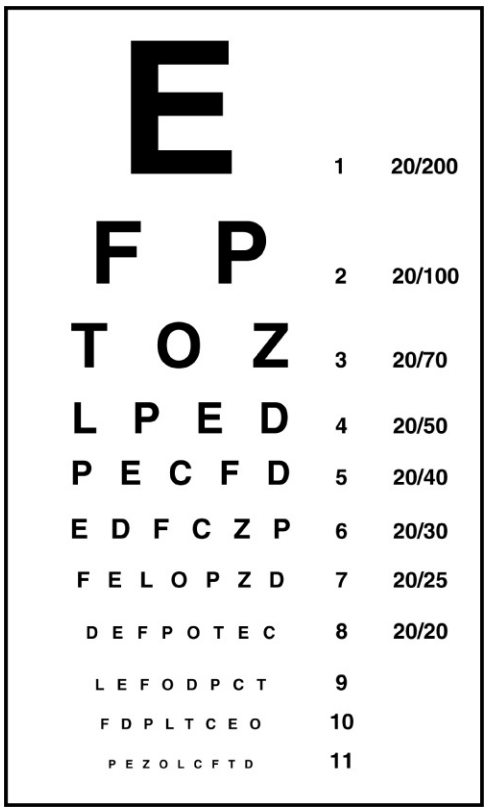


FIGURE 22.18 A Snellen chart is used to assess distance vision. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LINK TO LEARNING

A technique for how to perform a visual acuity test with a Snellen eye chart (https://openstax.org/r/77ViTestSnellen) is presented in this video.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Measuring Distance Visual Acuity

See the competency checklist for Measuring Distance Visual Acuity. You can find the checklists on the Student resources tab of your book page on openstax.org.

To assess near vision, explain to the patient that you will be assessing their ability to read small print at a close distance. A near vision chart, such as a Jaeger card (Figure 22.19), consists of paragraphs of text with varying font sizes. Ask the patient to hold the Jaeger card 14 to 16 inches from their eyes and read aloud the text on the chart starting from the largest font size. Proceed to smaller font sizes until the patient can no longer comfortably read the text. Note the font size at which the patient is able to read comfortably. For example, if they can read text labeled "J5," it means they can read text that is typically readable by a person with normal vision at a distance of 5 inches.

FIGURE 22.19 A Jaeger card is used to assess near vision. (credit: "111012-F-ZT401-067.JPG" by Airman 1st Class Brooke P. Beers, Public Domain)

Extraocular Movements

Assessing **extraocular movement** is an essential part of a neurological and ophthalmic examination. These movements involve the coordinated actions of the six muscles that control each eye's movement and alignment. Ensure proper lighting in the room and position the patient comfortably sitting or lying down, facing you. Explain to the patient that you will be assessing their eye movements to ensure their eyes can move smoothly in different directions. Test the six cardinal directions of gaze by asking the patient to keep their head still and follow a target (your fingertip or a pen) with their eyes only, without moving their head. Instruct the patient to focus on the target as you move it through the six cardinal directions of gaze: right (lateral), left (lateral), up (superior), down (inferior), upper-right diagonal, and upper-left diagonal. While the patient is tracking the target with their eyes, observe their eye movements for smooth and coordinated motions in each direction. An involuntary, rhythmic, back-and-forth movement of the eyes is termed **nystagmus** and is considered abnormal.

LINK TO LEARNING

How to test the six cardinal fields of gaze (https://openstax.org/r/77CardFieldGaze) is demonstrated in this video.

To test convergence, ask the patient to focus on an object (e.g., your fingertip) held about 2 inches in front of their nose. Slowly move the object toward the patient's nose while instructing them to keep looking at the object. Observe their eyes for convergence, where both eyes move inward. Abnormal findings, such as limited eye movements, jerky motions, or nystagmus, may indicate issues with the extraocular muscles, issues with the cranial nerves (particularly cranial nerves III, IV, and VI), or neurological problems.

Peripheral Vision

Assessing **peripheral vision**, also known as visual field, is important for detecting any abnormalities or defects in a person's ability to see objects in their side or peripheral vision. Ensure adequate lighting and seat the patient comfortably facing you, at eye level. Explain to the patient that you will be testing their ability to see objects in their side vision. To conduct the confrontation test, instruct the patient to cover one eye. Instruct the patient to keep their gaze fixed on your nose or another reference point in the center. Hold your hands or an object in each of the four quadrants of the patient's visual field: superior, inferior, temporal (side), and nasal (side). Ask the patient to tell you as soon as they see your fingers or the object you are holding in their peripheral vision. They should not look directly at the objects but should maintain their gaze on the center. Compare the patient's responses to the objects in each quadrant of the visual field to assess whether their peripheral vision is intact. If the patient consistently misses objects in certain quadrants, it could indicate peripheral vision deficits or defects, which may warrant further evaluation by an eye care professional or a more detailed visual field test. Assessing peripheral vision is crucial for detecting conditions like glaucoma, retinal disorders, and neurological issues that can affect peripheral vision.

LINK TO LEARNING

A technique for performing a peripheral vision test (https://openstax.org/r/77PeriphVisTest) is presented in this video.

Validating and Documenting Data

Data should be validated if discrepancies exist between subjective and objective data, significant changes occur between visits, or highly abnormal findings are noted. To validate the data, the nurse may need to repeat the physical assessment and clarify the subjective findings with the patient. Other times, the nurse may need another nurse or healthcare professional to verify the findings.

Accurate documentation is needed to promote effective communication among the interdisciplinary team. Documenting the results of an eye assessment begins with the chief complaint or reason for the assessment, whether it is routine, due to specific symptoms, or as part of a larger medical evaluation. Document the appearance of the eyes, eyelids, eyebrows, and surrounding skin. Note any swelling, redness, lesions, or abnormalities. Describe the color, texture, and any signs of inflammation, infection, or discoloration. Note the clarity of the cornea and any irregularities. Observe the color and shape of the iris. Measure and record the size of the pupils, documenting any irregularities, such as unequal sizes. Record observations of eye movements, smoothness, coordination, and the presence of nystagmus. Record the results of visual acuity tests (Snellen chart or other methods) for both near and far vision. Document the response of the pupils to light stimuli. Note if they constrict (miosis) in bright light and dilate (mydriasis) in dim light. Describe the patient's ability to focus on a near object and how the pupils constrict during this process. Document any additional tests that were performed, such as color vision, depth perception, or visual field tests, and also document the results.

Abnormalities of the Eye

When conducting a health assessment, it is important to be able to recognize abnormalities of the eye that impact the eyes' structures, functions, and visual perception. From common refractive errors that blur the clarity of vision, to more complex conditions affecting the external and internal structures of the eyes, these abnormalities demand attention and timely intervention. While there are many abnormalities that may be seen during the eye assessment, this section reviews the most common abnormalities.

Abnormalities of the External Eye

Abnormalities of the external eye refer to various visual, structural, or functional deviations from the normal appearance and function of the eye's outer structures. These abnormalities can result from various eye conditions, injuries, infections, or systemic disorders. Common abnormalities of the external eye, including conjunctivitis (pink eye), hordeolum (stye), chalazion, ptosis, ectropion, and exophthalmos can be found in Table 22.3.

Condition	Description	Visual Example
Conjunctivitis (also, pink eye)	Inflammation of the conjunctiva (thin membrane covering the sclera and inner eyelids) due to infections (bacterial, viral, or allergic), causing redness, itching, discharge, and tearing	(credit: "Swollen eye with conjunctivitis" by "Tanalai"/Wikimedia Commons, CC BY 3.0)
Hordeolum (also, stye)	A painful, localized infection or inflammation of an eyelid gland, resulting in a red, swollen lump along the eyelid's edge	(credit: "Stye02" by Andre Riemann/Wikimedia Commons, Public Domain)
Chalazion	A noninfectious bump on the eyelid caused by a blocked meibomian gland, leading to localized swelling, tenderness, and sometimes blurred vision	(credit: "Chalazion" by "jd"/Wikimedia Commons, Public Domain)

TABLE 22.3 **Abnormalities of the External Eye**

Condition	Description	Visual Example
Ptosis	Drooping of the upper eyelid due to weakened or paralyzed levator muscles, which can partially obstruct vision	(credit: "Congenitalptosis" by "Andrewya"/Wikimedia Commons, Public Domain)
Ectropion	Outward turning of the lower eyelid, leading to exposure of the inner eyelid and increased risk of dryness and irritation	(attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Exophthalmos	One or both eyeballs bulge or protrude abnormally from the eye sockets (orbits)	(credit: "Proptosis and lid retraction from Graves' Disease" by Jonathan Trobe, M.D./Wikimedia Commons, CC BY 3.0)

TABLE 22.3 **Abnormalities of the External Eye**

CLINICAL JUDGMENT MEASUREMENT MODEL

Prioritize Hypotheses: Identifying Conjunctivitis

The nurse is performing an assessment on a child who is being seen in the primary care office for red, itchy eyes. The nurse asks a series of questions to determine if the patient felt like they had something in their eye, experience seasonal allergies, and if there had been any discharge from the eye. The patient denied foreign bodies in the eye and allergies; however, the patient did mention the eye was crusted over with a yellow crust that morning upon waking up. The nurse analyzed the cues to hypothesize the patient was most likely

experiencing conjunctivitis (pink eye).

Abnormalities of the Internal Eye

Abnormalities of the internal eye refer to various disorders and conditions that affect the structures within the eye, including the retina, optic nerve, vitreous humor, and other components. These abnormalities can lead to changes in vision, visual disturbances, and potential vision loss. Common abnormalities of the internal eye include the following:

- Pterygium: A **pterygium** is a growth of tissue on the conjunctiva that can extend onto the cornea, often caused by excessive ultraviolet (UV) light exposure and leading to redness, irritation, and potential visual disturbances.
- Corneal abrasions or scars: A **corneal abrasion** is a scratch or injury to the cornea's surface, while a **corneal scar** is tissue that forms after the healing of a deeper injury. Both can cause pain, discomfort, and changes in vision.
- Cataracts: A **cataract** is a clouding of the eye's natural lens, leading to gradual vision loss, glare sensitivity, and decreased color perception (Figure 22.20).

(a) **(b)**

FIGURE 22.20 (a) A cataract causes the natural lens in the eye to become cloudy, causing blurred vision of (b) an originally clear image. (credit a: "Eye disease simulation, myopia.jpg" by National Eye Institute, National Institutes of Health, Public Domain; credit b: "Normal vision" by National Eye Institute, National Institutes of Health, Public Domain)

- Irregularly shaped iris: An irregularly shaped iris is observed when the colored part of the eye that surrounds the pupil has irregular contours, which can be congenital or associated with certain eye conditions.
- Mydriasis: In **mydriasis**, there is abnormal dilation of the pupil, often due to medication, neurological issues, or eye trauma (Figure 22.21).

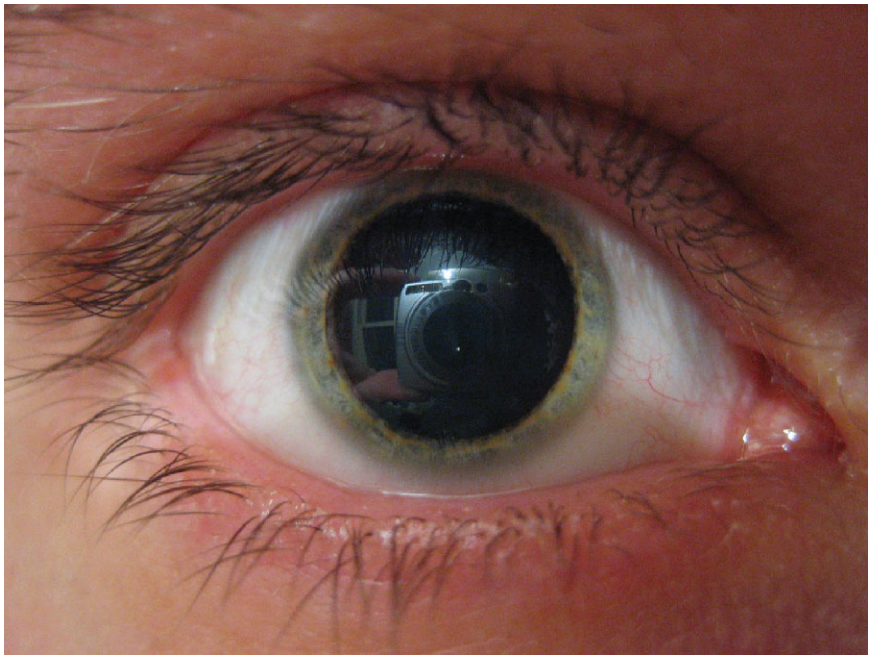


FIGURE 22.21 Individuals with mydriasis, or benign episodic unilateral mydriasis, will exhibit a dilated pupil in one eye and may also experience mild headaches, eye pain, sensitivity to light, and blurred vision. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

- Anisocoria: In **anisocoria**, there are unequal pupil sizes in both eyes, which can be normal or a sign of underlying neurological or eye problems.
- Miosis: In **miosis**, there is abnormal constriction of the pupil, often due to medication, bright light, or neurological conditions.
- Papilledema: In **papilledema**, there is swelling of the optic disc at the back of the eye due to increased intracranial pressure, which can be a sign of serious conditions like intracranial tumors or head injuries.
- Glaucoma: The term **glaucoma** is used for a group of eye disorders characterized by increased intraocular pressure that damages the optic nerve, causing gradual peripheral vision loss and potential blindness (Figure 22.22).

FIGURE 22.22 Someone who has glaucoma will gradually lose peripheral vision but retains central vision, which makes their vision similar to looking into a tube where things straight ahead appear clearly, but the sides look blurry or darkened. (credit: "Eye disease simulation, glaucoma.jpg" by National Eye Institute, National Institutes of Health, Public Domain)

- Optic atrophy: In **optic atrophy**, there is degeneration of the optic nerve fibers, leading to vision loss and pale optic discs on examination.
- Macular degeneration: In **macular degeneration**, there is gradual and progressive damage to the macula, which can lead to significant vision loss and impairment of daily activities that require clear central vision, such as reading and recognizing faces (Figure 22.23).

FIGURE 22.23 Visual changes associated with macular degeneration include blurred or distorted central vision, dark or empty spots in the central vision, and straight lines that appear wavy or crooked. (credit: "Eye disease simulation, age-related macular degeneration.jpg" by National Eye Institute, National Institutes of Health, Public Domain)

Visual Abnormalities

Common visual abnormalities that individuals might experience include the following:

- Myopia (nearsightedness): In **myopia (nearsightedness)**, distant objects appear blurry, while close objects are clear. It occurs when light focuses in front of the retina instead of directly on it.
- Hyperopia (farsightedness): In **hyperopia (farsightedness)**, distant objects are clearer than close ones. Light focuses behind the retina instead of directly on it.
- Astigmatism: With an **astigmatism**, blurred or distorted vision is due to an irregularly shaped cornea or lens, causing light to focus on multiple points rather than a single point.
- Presbyopia: In the age-related condition **presbyopia**, an individual has difficulty focusing on close objects due to a gradual loss of the eye's ability to change focus.
- Color blindness: Individuals with **color blindness** have difficulty distinguishing certain colors, often red and green or blue and yellow, due to a genetic deficiency in color-sensitive cone cells.
- Amblyopia (lazy eye): In **amblyopia (also, lazy eye)**, there is reduced vision in one eye due to improper development during childhood, often caused by unequal refractive errors or strabismus (misaligned eyes).
- Strabismus: Individuals with **strabismus** have misalignment of the eyes, causing one eye to turn inward, outward, upward, or downward while the other eye remains focused.
- Diplopia (double vision): When an individual has **diplopia** (double vision), they see two images of a single object. This is often caused by misalignment of the eyes, neurological issues, or eye muscle problems.
- Floater: A **floater** is a small, semitransparent spot or shape that appears to "float" in the field of vision due to debris in the vitreous humor.
- Flash: A **flash** is a brief, flickering light or sensation that occurs in the visual field, often caused by traction on the retina or vitreous humor.
- Photophobia: An individual who has **photophobia** has sensitivity to light, leading to discomfort and squinting in bright environments.
- Night blindness: An individual who has **night blindness** has difficulty seeing in low-light conditions due to reduced function of the rod cells in the retina.
- Halo: A **halo** is a glowing circle or ring around a light source, often seen by individuals with cataracts or after

refractive surgery.

22.3 Ears

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Examine the structures and function of the ears
- Recognize how to perform a nursing assessment of the ears
- Remember different abnormalities of the ear

The human ear is a remarkable sensory organ responsible for two vital functions: hearing and maintaining equilibrium. A nursing assessment of the ear involves a systematic evaluation of the ear's external and internal structures as well as the identification of any abnormalities that might affect hearing, balance, or overall well-being. By understanding the complexities of ear structure and function, nurses are better equipped to ensure optimal ear health and quality of life for their patients.

Structures and Function

The human ear consists of three main parts: the outer ear, the middle ear, and the inner ear (Figure 22.24). Each part has distinct structures and functions that contribute to the overall process of hearing and equilibrium. The outer ear collects and funnels sound, the middle ear amplifies and transmits it, and the inner ear converts sound into electrical signals for the brain, while also playing a crucial role in balance and spatial orientation.

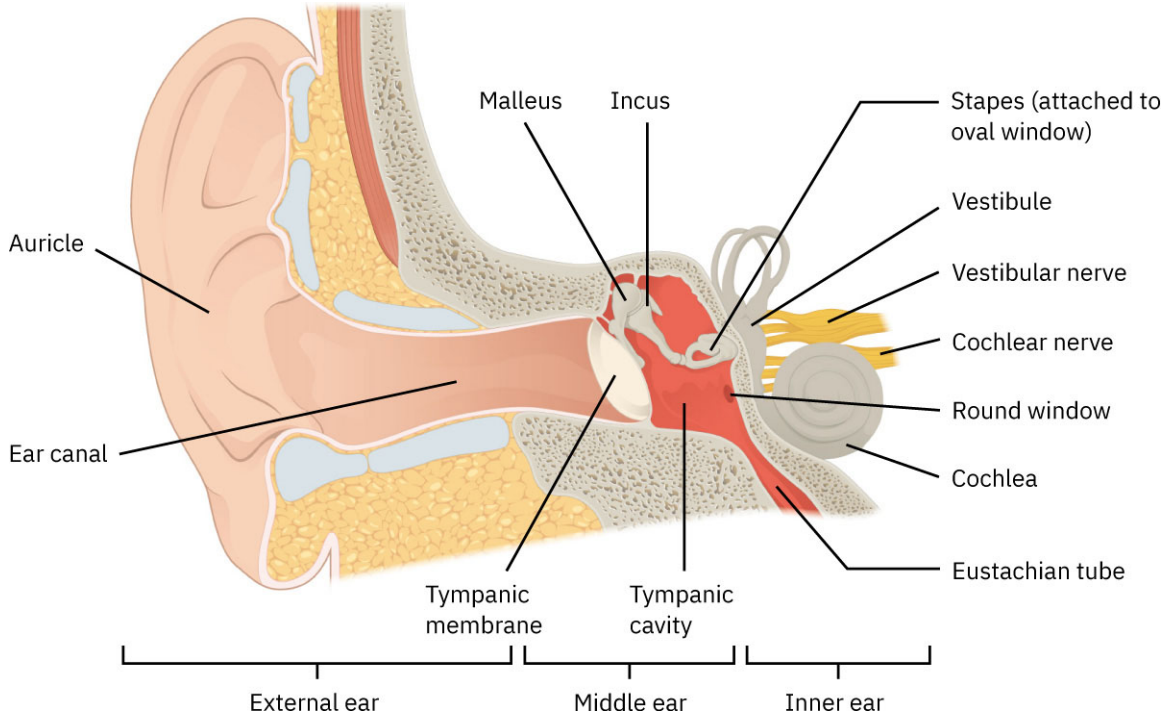


FIGURE 22.24 Ear anatomy can be classified as the external ear, middle ear, and inner ear. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

External Ear

The **external ear** is composed of the pinna (auricle) and the external auditory canal. The pinna (also, auricle) is the visible external part of the ear that is made up of cartilage and skin. It helps to collect sound waves from the environment and funnel them into the ear canal. The **external auditory canal** is a tubelike structure that connects the pinna to the eardrum. The canal is approximately an inch in length and is very sensitive to pain and pressure. The external auditory canal amplifies and directs sound waves toward the middle ear.

Middle Ear

The middle ear is a small, air-filled chamber located between the outer ear and the inner ear. It plays a crucial role in transmitting and amplifying sound vibrations from the eardrum to the inner ear. The middle ear is composed of

the eardrum (tympanic membrane), ossicles, and eustachian tube. The tympanic membrane (also, eardrum) is a thin, cone-shaped membrane that separates the outer ear from the middle ear. It vibrates when struck by sound waves, transmitting these vibrations to the middle ear's bones. The ossicles are the three tiny bones in the middle ear: the malleus (hammer), incus (anvil), and stapes (stirrup). The malleus (also, hammer) is attached to the inner surface of the eardrum and transmits vibrations from the eardrum to the incus. The incus (also, anvil), located between the malleus and the stapes, transmits vibrations from the malleus to the stapes. The stapes (also, stirrup), which is the smallest bone in the human body, transmits vibrations from the incus to the oval window of the cochlea. These bones amplify and transmit the vibrations from the eardrum to the fluid-filled inner ear. The **eustachian tube** connects the middle ear to the back of the nose. Its primary function is to equalize air pressure between the middle ear and the atmosphere, which is essential for maintaining proper hearing and preventing discomfort.

Inner Ear

The **inner ear**, composed of the cochlea and the vestibular system, is responsible for hearing and balance. The **cochlea** is a snail-shaped, fluid-filled structure responsible for converting sound vibrations into electrical signals that the brain can interpret as sound. It contains thousands of hair cells, which are specialized sensory cells that bend in response to fluid movement, initiating the hearing process. The **vestibular system** includes the semicircular canals and the vestibule, which are responsible for maintaining balance and spatial orientation. The semicircular canals detect rotational movements of the head, while the vestibule senses changes in linear acceleration and gravity.

Hearing

Hearing is a complex process that involves the conversion of sound waves in the environment into meaningful auditory perceptions in the brain. Sound waves are generated by vibrating objects, such as vocal cords, musical instruments, or any other source that creates vibrations in the air. These sound waves are essentially fluctuations in air pressure that propagate as waves of compressions and rarefactions through the air.

The sound waves are collected by the outer ear via the pinna. The pinna's shape and orientation help to capture sound waves from various directions. The collected sound waves travel through the external auditory canal and strike the eardrum. The eardrum vibrates in response to the incoming sound waves. The vibration's intensity and frequency are determined by the characteristics of the sound waves. The vibration of the eardrum is then transmitted to the three tiny bones in the middle ear: the ossicles (malleus, incus, and stapes). The ossicles amplify the vibrations, ensuring that the weak vibrations from the eardrum are transformed into stronger vibrations to the inner ear and cochlea. Once the sound waves reach the inner ear, they are converted into electrical impulses. The electrical signals generated by the activated hair cells are then transmitted to the auditory nerve fibers, which carry these electrical signals to the brain for further processing. The brain then translates these electrical impulses as sound.

Nursing Assessment: Inspecting and Palpating the Ears

Inspecting and palpating the ear are an essential part of a nursing assessment to identify any abnormalities, infections, or issues that might be affecting the patient's hearing or overall health. Inspecting the ear involves the nurse looking at the external ear, ear canal, and tympanic membrane. Palpating the ear involves the nurse feeling the external ear and mastoid process. A thorough ear assessment collects both subjective and objective data as well as validates and accurately documents the data.

Subjective Data

During an ear assessment, gathering subjective data through patient interviews is crucial to understanding one's ear health history, concerns, and any symptoms they may be experiencing. Some key areas to explore when collecting subjective data related to ear assessment include the following:

1. Chief complaint and history of present illness:
    - Ask the patient to describe their primary concern or reason for seeking ear assessment.
    - Inquire about the onset, duration, and progression of any ear-related symptoms, such as pain, discomfort, hearing loss, **tinnitus** (ringing, buzzing, or hissing sounds in the ears), **vertigo** (sensation of spinning or dizziness), or balance problems.
2. Hearing changes:

- Explore any recent changes in hearing, including difficulty hearing conversations, needing increased volume on devices, or missing certain sounds. Explain that any decrease in hearing is considered hearing loss.
- Ask about exposure to loud noises, ear infections, or a family history of hearing loss.

3. Ear infections and discharge:
   - Inquire about any history of ear infections, including frequency and treatment.
   - Ask if there is any history of ear discharge, its color, consistency, and associated symptoms.
4. Pain and discomfort:
   - Assess the location, intensity, quality, and duration of any ear pain or discomfort.
   - Ask about factors that worsen or alleviate the pain, such as movement, pressure changes, or specific activities.
5. History of ear surgery or procedures:
   - Inquire about any previous surgeries or procedures related to the ears, such as ear tube insertion or ear surgery for hearing correction.
6. Medications:
   - Ask about any medications the patient is currently taking, including over-the-counter drugs, prescription medications, or herbal supplements.

LINK TO LEARNING

Some medications can damage the ear, causing hearing loss, ringing in the ears, or balance problems. Medications that result in this side effect are known as ototoxic medications. There are over 200 known ototoxic medications on the market today. A list of ototoxic medications (https://openstax.org/r/77OtotoxicMeds) to be aware of as you conduct ear assessments is provided at this website.

7. Medical history:
   - Explore the patient's medical history, including chronic conditions (e.g., diabetes, hypertension) that may impact ear health.
   - Inquire about autoimmune disorders, as some can affect hearing and ear health.
8. Personal habits:
   - Inquire about habits such as cleaning the ears with objects like cotton swabs or inserting foreign objects into the ears, which can cause harm.
9. Impact on daily life:
   - Discuss how ear-related symptoms impact the patient's daily activities, communication, work, and overall quality of life.

Objective Data

When conducting an objective assessment of the ears, nurses gather physical information through inspection, palpation, and specialized tests. Key components of objective data collection during an ear assessment include the following:

1. Inspection of external ear:
   - Observe the external ear for any abnormalities, asymmetry, lesions, deformities, or signs of inflammation.
   - Note the condition of the skin, presence of scars, redness, swelling, or discharge around the ear.
2. Palpation of external ear:
   - Gently palpate the external ear for tenderness, warmth, or pain.
   - Palpate the **mastoid process** (bony prominence behind the ear) for tenderness or swelling.
3. Assessment of ear canal:
   - Using an otoscope (a medical instrument consisting of a light source and a magnifying lens to examine the external ear canal and the eardrum), visualize the ear canal for signs of obstruction, inflammation, discharge, or foreign bodies.
   - Note the color and condition of the ear canal skin.

LIFE-STAGE CONTEXT

Variations in Assessing the Ear Canal

Using an otoscope to examine the ears of adults and young children requires some differences in approach due to variations in anatomy, patient cooperation, and comfort. Here are some key differences:

- Patient cooperation:
  - Adults: Adults can typically follow instructions, remain still, and cooperate during the examination, making it easier to use an otoscope.
  - Young children: Young children, especially infants and toddlers, may not understand or follow instructions, and they are more likely to move or cry during the examination. It may require the assistance of a parent or caregiver to hold the child still and keep them calm.
- Positioning:
  - Adults: Adults can often sit upright, making it easier to examine their ears with a standard otoscope. They can tilt their head to facilitate access to the ear canal.
  - Young children: Children may need to be held in a specific position by a caregiver. For infants, this often involves holding them securely and gently tilting their head for ear examination. Toddlers may sit on a caregiver's lap or lie down, depending on their age and comfort.
- Size of ear canal:
  - Adults: Adult ear canals are typically larger and straighter, allowing for easier insertion of the otoscope.
  - Young children: The ear canal of a child is smaller, shorter, and may have a more acute angle. Care must be taken to avoid causing discomfort or injury during otoscopic examination.
- Type of otoscope and speculum:
  - Adults: A standard otoscope with a larger speculum may be used for adults to visualize the ear canal effectively.
  - Young children: A smaller-sized otoscope with a pediatric speculum is often used for young children to accommodate their smaller ear canals.

4. Tympanic membrane examination:
   - Use an otoscope to examine the eardrum (tympanic membrane) for color, position, integrity, and landmarks.
   - Note the presence of perforations, fluid, bulging, or retraction of the tympanic membrane.
5. Weber and Rinne tests:
   - Use a tuning fork (a handheld, two-pronged metal instrument that emits a specific musical tone when struck) to perform the Weber and Rinne tests to assess hearing and identify potential conductive or sensorineural hearing loss (Figure 22.25).
   - The **Weber test** is used to determine whether hearing loss is present in one ear or if it is roughly equal in both ears. Strike the tuning fork to create vibrations. Place the base of the vibrating tuning fork on the patient's forehead or midline of the skull, equidistant from both ears. Ask the patient if they hear the sound louder in one ear, both ears equally, or if they cannot tell. If the patient hears the sound equally in both ears, this suggests symmetrical hearing or normal hearing. If the patient hears the sound louder in one ear, this suggests hearing loss.
   - The **Rinne test** compares air conduction (AC) and bone conduction (BC) to assess whether hearing loss is due to conductive or sensorineural factors. Strike the tuning fork and place it gently on the patient's mastoid bone behind one ear until the sound is no longer heard. Without delay, move the still-vibrating tuning fork next to the external auditory canal (AC) and ask the patient if they hear the sound again. Compare the time the patient hears the sound during BC (mastoid) and AC (auditory canal). If the patient hears the sound longer through AC than through BC (positive Rinne), this suggests normal or sensorineural hearing in that ear. If the patient hears the sound equally or longer through BC than through AC (negative Rinne), this suggests conductive hearing loss in that ear.

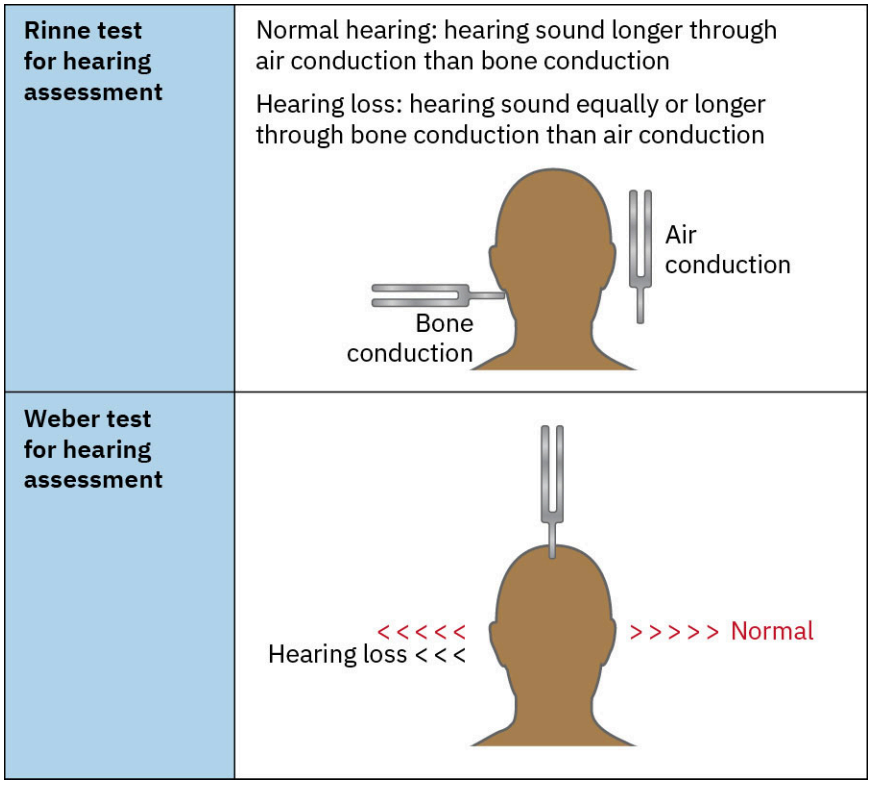


FIGURE 22.25 Weber and Rinne tests assess hearing using a tuning fork. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

6. Assessment of balance and equilibrium:
   - Observe the patient's posture, gait, and balance while standing, walking, or performing specific maneuvers (e.g., Romberg test) to assess equilibrium.
   - To perform the **Romberg test** (clinical assessment used to assess balance), instruct the patient remove their shoes and stand with their feet together, heels touching, and arms by their sides. Instruct the patient to stand still with their eyes open and maintain their balance for about twenty to thirty seconds. Observe the patient's ability to maintain a steady posture during this time. After the eyes-open position, instruct the patient to close their eyes while maintaining the same stance. Observe the patient's ability to maintain balance with their eyes closed for the same duration (20 to 30 seconds). If the patient can maintain balance in both positions without swaying significantly, the Romberg test is considered normal. If the patient sways, loses balance, or needs to step or move to prevent falling while their eyes are closed (but maintained balance with eyes open), the test is considered positive, which may indicate an inner ear problem, peripheral neuropathy, or other neurological conditions affecting balance. If the patient sways or loses balance regardless of whether their eyes are open or closed, the test result is negative, which might suggest more severe balance issues or issues unrelated to proprioception or the vestibular system.
7. Assessment of facial nerve function:
   - Observe for any facial asymmetry, weakness, or twitching that could indicate involvement of the facial nerve (cranial nerve VII).

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Measuring Hearing Acuity

See the competency checklist for Measuring Hearing Acuity. You can find the checklists on the Student resources tab of your book page on openstax.org.

Validating and Documenting Findings

Validating ear assessment findings involves ensuring the accuracy and reliability of the information gathered during

the assessment process. This validation step is crucial for maintaining high-quality patient care, accurate medical records, and effective communication among healthcare professionals. If necessary, repeat certain aspects of the assessment to confirm the consistency of findings. This is especially important when dealing with subjective symptoms like hearing loss or vertigo. Ensure you use proper and calibrated equipment, such as an otoscope with a functioning light source, to accurately examine the external ear, ear canal, and tympanic membrane. If the patient has a history of ear assessments, compare your current findings to previous records to identify any changes or trends. This can be helpful in tracking the progression of conditions. If you have any doubts about your findings, consider seeking a second opinion from a colleague. Review your findings with the patient to ensure that their self-reported symptoms match your assessment, as patients may sometimes have additional information that can clarify certain findings. Relate your findings to the patient's medical history, symptoms, and overall clinical presentation to ensure your findings are consistent and make sense in the context of the patient's condition.

Documenting an ear assessment is an important aspect of healthcare practice as it ensures accurate communication of findings and helps with patient care continuity. Begin by noting the reason the patient is undergoing an ear assessment, such as complaints of pain, hearing loss, tinnitus, or other symptoms. Document relevant medical history, including any preexisting conditions, past ear infections, surgeries, or allergies. Detail the specific symptoms the patient is experiencing, such as ear pain, drainage, ringing in the ears, vertigo, or any discomfort. Describe the external ear's appearance, noting any abnormalities, lesions, redness, swelling, or deformities. Document findings from the ear canal examination, including the presence of **cerumen** (earwax), signs of inflammation, foreign bodies, or discharge. Provide a thorough description of the tympanic membrane's appearance, noting its color, position, integrity, landmarks (malleus, cone of light), and any abnormalities like perforations, scarring, or bulging. If applicable, include the results of any hearing tests performed during the assessment. Describe any observations related to balance or coordination, especially if the patient reported symptoms of dizziness or vertigo. Add any additional details that might be relevant, such as the patient's response to treatment or any changes observed during the assessment.

Abnormalities of the Ear

Abnormalities of the ear can encompass a wide range of conditions affecting the external, middle, or inner ear. Many abnormalities of the ear may result in common symptoms, such as hearing loss, tinnitus, and vertigo. Hearing loss is classified as conductive hearing loss or sensorineural hearing loss.

A **conductive hearing loss** occurs when something in the external or middle ear is obstructing the transmission of sound. For example, cerumen impaction or a perforated tympanic membrane can cause conductive hearing loss. A **sensorineural hearing loss** is caused by pathology of the inner ear, cranial nerve VIII, or auditory areas of the cerebral cortex. Sensorineural hearing loss that occurs with aging due to gradual nerve degeneration is termed **presbycusis**. Ototoxic medications can also cause sensorineural hearing loss by affecting the hair cells in the cochlea.

LINK TO LEARNING

Check out the World Health Organization's fact sheet on deafness and hearing loss (https://openstax.org/r/77WHODeafSheet) to learn more about hearing loss and deafness, including causes, preventive measures, and management options.

Tinnitus is a ringing, buzzing, roaring, hissing, or whistling sound in the ears that may be intermittent or continuous. Tinnitus can be caused by cerumen impaction, noise trauma, or ototoxic medications. Military personnel have a high incidence of tinnitus due to noise trauma from loud explosions and gunfire. There are no medications to treat tinnitus; however, patients can be referred to an otolaryngologist for treatment such as cognitive therapy or noise masking.

Vertigo is a type of dizziness characterized by a false sensation of spinning or movement. It is often described as feelings of spinning, tilting, swaying, or the world around the individual is spinning, even when they are stationary. Vertigo can be quite distressing and can lead to feelings of nausea, vomiting, imbalance, and difficulty with daily activities. It is important to differentiate vertigo from other types of dizziness, such as lightheadedness (feeling

faint) or unsteadiness, as these sensations can stem from different causes. Treatment for vertigo depends on the underlying cause. It might involve medications to manage symptoms, physical therapy exercises to retrain the brain's response to balance signals, or in some cases, surgical intervention.

Abnormalities of the External Ear and Canal

Abnormalities of the external ear and ear canal can vary widely and may affect appearance, hearing, and overall ear health. Some examples of abnormalities that can impact the external ear and ear canal include the following:

- Microtia: In the congenital condition **microtia**, the external ear is underdeveloped or absent. It can range from mild deformities to a complete absence of the ear.
- Macrotia: The condition **macrotia** involves having abnormally large ears compared to typical proportions.
- Stahl ear: Also known as "Spock ear," **Stahl ear** involves a pointed or elflike appearance of the upper part of the ear due to an extra fold (Figure 22.26).

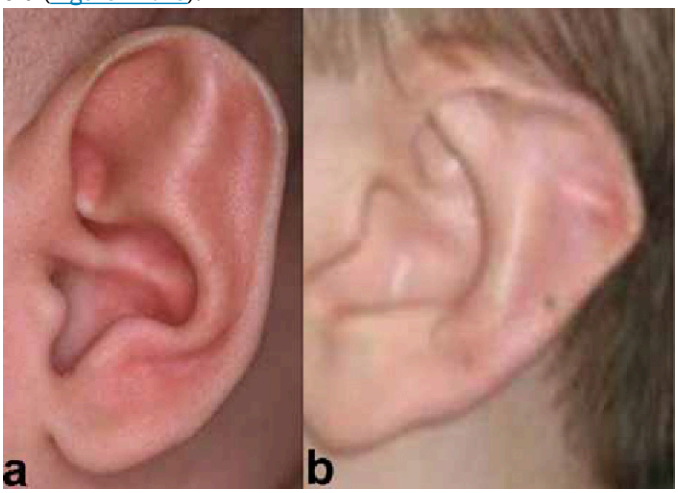


FIGURE 22.26 Compare (a) an ear without Stahl condition to an (b) ear with Stahl condition. Stahl ear is caused by misshapen cartilage and is characterized by an extra horizontal fold of cartilage. (credit: "Stahl Ear" by National Human Genome Research Institute, Public Domain)

- Cauliflower ear: Often seen in individuals who participate in contact sports, **cauliflower ear** occurs when repeated trauma to the ear leads to a buildup of blood or other fluids in the cartilage, causing it to become deformed and resemble a cauliflower (Figure 22.27).

FIGURE 22.27 Cauliflower ear is a deformity to the auricle caused by blunt force trauma. (credit: "Cauliflower ear" by "MartialArtsNomad.com"/Wikimedia Commons, CC BY 2.0)

- Otitis externa: Also known as "swimmer's ear," **otitis externa** is an infection or inflammation of the external ear canal, usually caused by water exposure or bacterial/fungal infections (Figure 22.28). Otitis externa causes the ear canal to be erythematous and edematous with associated yellow, white, or gray debris. Patients often report itching in the ear canal with pain that is worsened by pulling upward and outward on the auricle. Otitis externa is treated with antibiotic drops placed in the ear canals.

FIGURE 22.28 Swimmer's ear is characterized by redness or swelling (inflammation), irritation, or infection to the outer ear canal. (credit: "Otitis externa" by Klaus D. Peter/Wikimedia Commons, CC BY 3.0)

- Earwax impaction: An **earwax impaction** is a buildup of earwax (cerumen) that can lead to discomfort and hearing loss and even contribute to ear infections. Cerumen can be removed via irrigation of the ear canal, eardrops to dissolve the wax, or manually.

REAL RN STORIES

Earwax Impaction

Nurse: Jackson, RN
Clinical setting: Pediatric primary care clinic
Years in practice: 22
Facility location: Birmingham, Alabama

One time, we had an 8-year-old child come in with symptoms of a cold. Upon looking in the child's ears, the provider noticed the ear was impacted with earwax. The child reported the ear had been hurting a bit (resembling pain associated with an ear infection). We performed irrigation in the office, and you could not believe the earwax that came out of the child's ear. It looked like a tree trunk of earwax. In all of my twenty-two years in practice, I have never seen so much wax in a child's ear, particularly that came out of the ear in one piece. After irrigating the ear, the child reported they could hear much better, and the provider was able to visualize the eardrum, noting the child's eardrum was red, swollen, and infected. The child was prescribed antibiotics for the ear infection; however, there is no doubt the child could hear better after getting all of that wax out.

- Foreign body in the ear canal: Any foreign body in the ear canal that becomes lodged in the canal can cause pain, discomfort, and potential damage to the ear canal or tympanic membrane.
- Congenital ear tags and pits: Small pieces of extra tissue (a **congenital ear tag**) or small depressions (a

congenital ear pit) near the external ear can be present at birth.

Abnormalities of the Tympanic Membrane

Abnormalities of the tympanic membrane can impact hearing and overall ear health. The following are some examples of abnormalities that can affect the tympanic membrane:

- Perforated eardrum: A **perforated eardrum** is a condition where there is a hole or tear in the tympanic membrane. It can result from infections, trauma, or sudden changes in pressure (such as from a loud noise). A perforated eardrum can cause hearing loss, ear pain, and susceptibility to infections.
- Tympanosclerosis: The condition called **tympanosclerosis** involves the formation of thickened or scarred areas on the eardrum due to repeated infections or inflammation. Tympanosclerosis can affect hearing if it covers a significant portion of the eardrum.
- Tympanic membrane retraction: In **tympanic membrane retraction**, the eardrum is pulled or retracted into the middle ear. This can occur due to negative pressure in the middle ear and can lead to chronic ear infections and hearing problems.
- Myringitis: An inflammation of the eardrum termed **myringitis** can cause pain, discomfort, and sometimes even small blisters on the surface of the eardrum.
- Otitis media (middle ear infection): Acute **otitis media** typically occurs after an upper respiratory infection when the eustachian tube becomes inflamed and the middle ear fills with fluid, causing ear pain and irritability. This fluid can become infected, causing purulent fluid and low-grade fever. Acute otitis media is diagnosed by a healthcare provider using an otoscope to examine the tympanic membrane for bulging and purulent fluid. Chronic or recurrent ear infections can lead to repeated inflammation of the tympanic membrane, potentially causing scarring or functional issues. Individuals with chronic ear infections may have "tubes" placed in the tympanic membrane to drain the fluid from the middle ear and prevent infection from developing.

Abnormalities of the Inner Ear

Abnormalities of the inner ear can lead to various hearing and balance disorders, as the inner ear plays a crucial role in both auditory and vestibular (balance) functions. The following are some examples of abnormalities that can affect the inner ear:

- Sensorineural hearing loss: One of the most common types of hearing loss, **sensorineural hearing loss** results from damage to the hair cells in the inner ear or the auditory nerve. It can be congenital or acquired due to factors such as aging, noise exposure, genetics, infections, or certain medications.
- Ménière disease: **Ménière disease** is a disorder of the inner ear characterized by episodes of vertigo (spinning sensation), fluctuating hearing loss, tinnitus (ringing in the ears), and a feeling of fullness or pressure in the ear.
- Labyrinthitis: An inflammation of the inner ear is termed **labyrinthitis**, often caused by viral infections. It can lead to sudden onset of vertigo, hearing loss, and imbalance.
- Inner ear trauma: Trauma to the head or ears can result in inner ear trauma, damage that leads to hearing loss, dizziness, and other symptoms.

22.4 Mouth, Throat, Nose, and Sinuses

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the structures and functions of the mouth, throat, nose, and sinuses
- Understand how to perform a nursing assessment of the mouth, throat, nose, and sinuses
- Verbalize different abnormalities of the mouth, throat, nose, and sinuses

The intricate web of structures comprising the mouth, throat, nose, and sinuses is a testament to the remarkable complexity of the human body. These interconnected systems serve as more than mere conduits for air, food, and sound. They orchestrate essential functions that encompass everything from nourishment and communication to protection and sensory perception. Understanding the anatomy of the body's structures is crucial for performing an effective and accurate physical assessment. When conducting assessments of the mouth, throat, nose, and sinuses, knowledge of their anatomy guides the nurse in using appropriate techniques and interpreting findings.

Structures and Function

To perform an accurate assessment of the mouth, throat, nose, and sinuses, it is important to understand their structure and functions. By aligning assessment techniques with the anatomy of these structures, nurses can gather meaningful information, detect abnormalities, and initiate appropriate interventions. Furthermore, this understanding helps differentiate between normal anatomical variations and potential signs of health issues, ensuring a comprehensive and accurate assessment.

Mouth

The mouth, also known as the oral cavity, is a key anatomical feature located at the opening of the digestive and respiratory tracts. It is composed of lips, teeth, jaws, tongue, palate, uvula, and salivary glands. The lips enclose the entrance to the mouth and are richly supplied with sensory nerves for touch and temperature sensation. The masseter muscle is the main muscle used for chewing because it elevates the mandible (lower jaw) to close the mouth. It is assisted by the temporalis muscle that retracts the mandible. The temporalis muscle can be felt moving by placing fingers on the patient's temple as they chew (Figure 22.29).

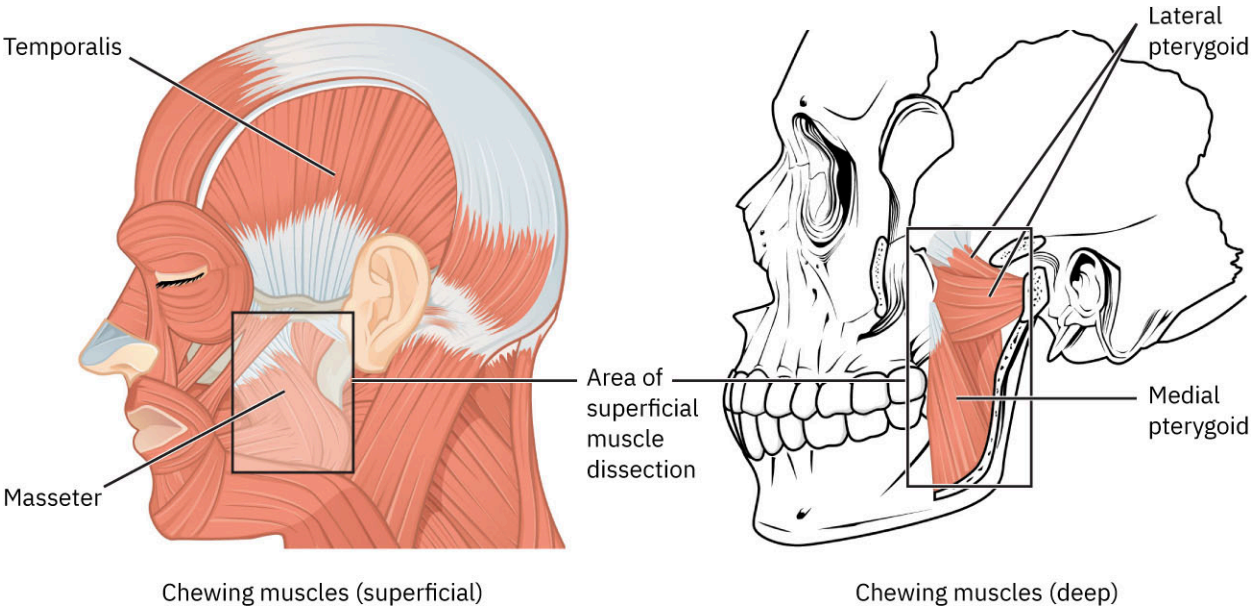


FIGURE 22.29 Masseter and temporalis muscles found in the jaw are used for chewing. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Teeth are hard structures used for biting and chewing food. They play a role in breaking down food into smaller pieces for digestion. The tongue is a muscular organ that aids in tasting, swallowing, and speaking. It is covered with taste buds that help distinguish between different flavors. The palate consists of the hard palate (bony anterior portion) and the soft palate (muscular posterior portion). The soft palate helps close off the nasal passages during swallowing to prevent food from entering the nose. The uvula is a small, fleshy mass that hangs from the back of the soft palate. It plays a role in speech and the closing of the nasal passages during swallowing. Salivary glands produce saliva, which helps break down food, aids in swallowing, and contains enzymes that start the process of digestion.

The mouth is a multifunctional structure involved in various important activities such as eating, tasting, speaking, and initiating digestion. The mouth is the starting point of the digestive process. It receives food and beverages, which are broken down into smaller pieces by chewing. Teeth are used to chew and grind food into smaller pieces that are easier to digest. The tongue contains taste buds that detect different flavors: sweet, sour, salty, bitter, and savory. The mouth's sensory receptors also help us detect temperature and texture.

The tongue, lips, and other oral structures are essential for forming speech sounds and producing language. Salivary glands in the mouth produce saliva, which moistens food, begins the digestion of starches through enzyme action, and helps lubricate the mouth and throat. The mouth also has immune defenses that help prevent infections, such as antibodies contained in saliva that fight harmful bacteria.

Throat

The **pharynx**, or throat, is a tube-lined mucous membrane that begins at the nasal cavity and is divided into three major regions: nasopharynx, oropharynx, and laryngopharynx (Figure 22.30). The pharynx's structure allows it to serve as a conduit for both air and food and participate in breathing, swallowing, speech production, and protection of the airway.

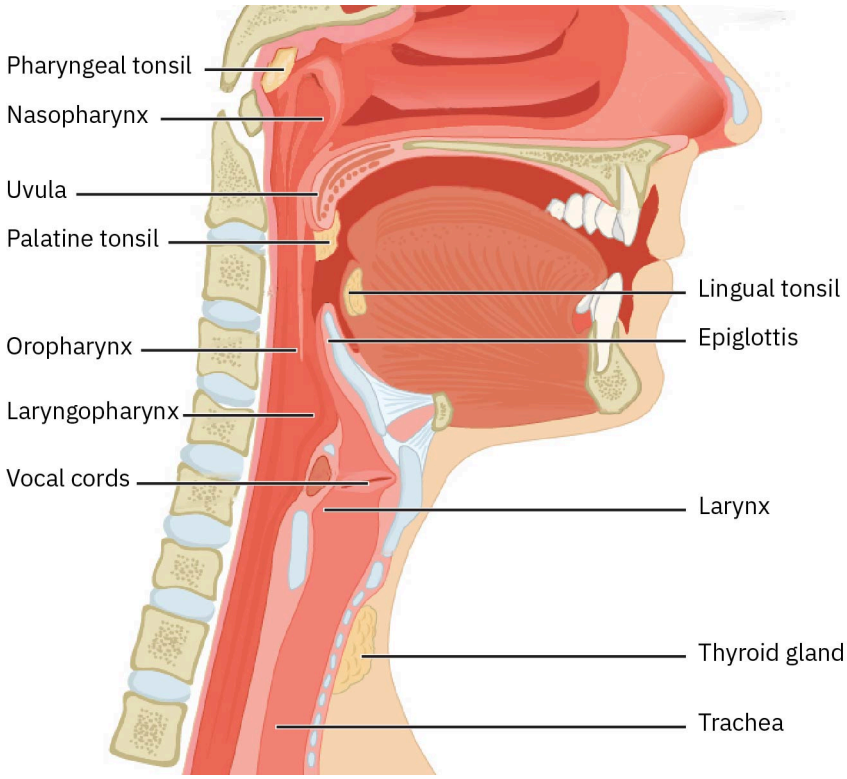


FIGURE 22.30 The throat (or pharynx) makes up a large area of the head and neck. It can be divided into three areas: nasopharynx, oropharynx, and laryngopharynx. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

The nasopharynx is the upper portion of the throat, located behind the nasal cavity. It is primarily responsible for conducting air and allowing the passage of air during breathing. At the top of the nasopharynx is the pharyngeal tonsil, commonly referred to as the adenoids. The **adenoids** are lymphoid tissues that trap and destroy invading pathogens that enter during inhalation.

The oropharynx is the middle portion of the throat, located behind the mouth. It serves as a passageway for both air and food as well as being involved in speech and taste. The oropharynx contains two sets of tonsils, the palatine and lingual tonsils. The palatine tonsil is located laterally in the oropharynx, and the lingual tonsil is located at the base of the tongue. Similar to the pharyngeal tonsil, the palatine and lingual tonsils are composed of lymphoid tissue and trap and destroy pathogens entering the body through the oral or nasal cavities.

The laryngopharynx is the lower portion of the throat, located behind the larynx. It acts as a pathway for food and air, leading to the esophagus and trachea, respectively. The **larynx** connects the pharynx to the trachea and helps regulate the volume of air that enters and leaves the lungs. It also contains the vocal cords that vibrate as air passes over them to produce the sound of a person's voice. The **epiglottis** is a flexible piece of cartilage that covers the opening of the trachea during swallowing to prevent ingested material from entering the trachea.

Nose

The nose is a prominent facial feature with a complex structure that serves various functions. It consists of both external and internal components. External components of the nose include the nasal bridge and nostrils. The nasal bridge is the upper part of the nose, formed by the nasal bones and the frontal bone. While the bridge is formed by bones, the protruding portion that composes what we see as "the nose" is made of cartilage. Nostrils, also called nares, are the openings through which air enters the nasal passages. Internal components of the nose include the

nasal septum, nasal cavities, and **turbinates**. The **nasal septum** is the internal wall, composed of bone and cartilage, that divides the nose into left and right nostrils. Nasal cavities are hollow spaces behind the nostrils that are lined with mucous membranes and extend to the back of the throat. Turbinates, also known as nasal conchae, are bony structures covered in mucous membranes that protrude into the nasal cavities and help to humidify and filter the air.

The nose serves multiple important functions, including facilitating breathing, detecting smells, influencing speech, contributing to immune defense, and aiding in temperature regulation. As air passes through the nasal passages, it gets warmed, humidified, and filtered by the mucous membranes and turbinates, which prepares the air for entry into the lungs. The olfactory epithelium in the upper part of the nasal cavities contains specialized receptors that allow us to detect and perceive different scents (smell or **olfaction**). The information about smells is transmitted to the brain, contributing to the sense of taste (**gustation**). The shape of the nasal passages and the resonance chambers within the nasal cavities influence voice quality. The mucous membranes lining the nasal passages produce mucus that traps dust, microbes, and other particles. Cilia (tiny hairlike structures) move the mucus toward the throat, where it is swallowed and neutralized by stomach acids. The blood vessels in the nasal cavities help regulate the temperature of the air breathed in. As the air passes through the nasal passages, it exchanges heat with the blood vessels, helping to maintain a stable body temperature.

Sinuses

The **paranasal sinuses** are a group of air-filled spaces within the bones of the face and skull, located around the nose and above the eyes. The sinuses connect to the nasal cavity and are lined with nasal mucosa. The sinuses help reduce the overall weight of the skull, making it easier for the neck muscles to support the head and allowing us to move our heads more freely. They may play a role in modifying the resonance and quality of the voice. For example, when a person has a cold or sinus congestion, the mucosa swells and obstructs the nasal passage, which may lead to the person sounding “stopped up.” The air inside the sinuses helps insulate the sensitive structures in the skull, such as the eyes and brain, from temperature fluctuations. As air passes through the nasal passages, it is warmed and moistened by the mucous membranes lining the sinuses and nasal cavities, which helps protect lung tissues from cold, dry air. The sinuses also produce mucus, which can trap airborne particles, such as dust and microbes, from entering the cranial cavity.

The paranasal sinuses are named after the bones in which they are located (Figure 22.31). The main types of sinuses are as follows:

- Frontal sinuses: Located in the forehead bone (frontal bone).
- Maxillary sinuses: Situated in the cheekbones (maxilla), below the eyes.
- Ethmoid sinuses: Found between the eyes, within the ethmoid bone. These sinuses are composed of numerous small compartments.
- Sphenoid sinuses: Located deep within the skull, behind the ethmoid sinuses and between the eyes.

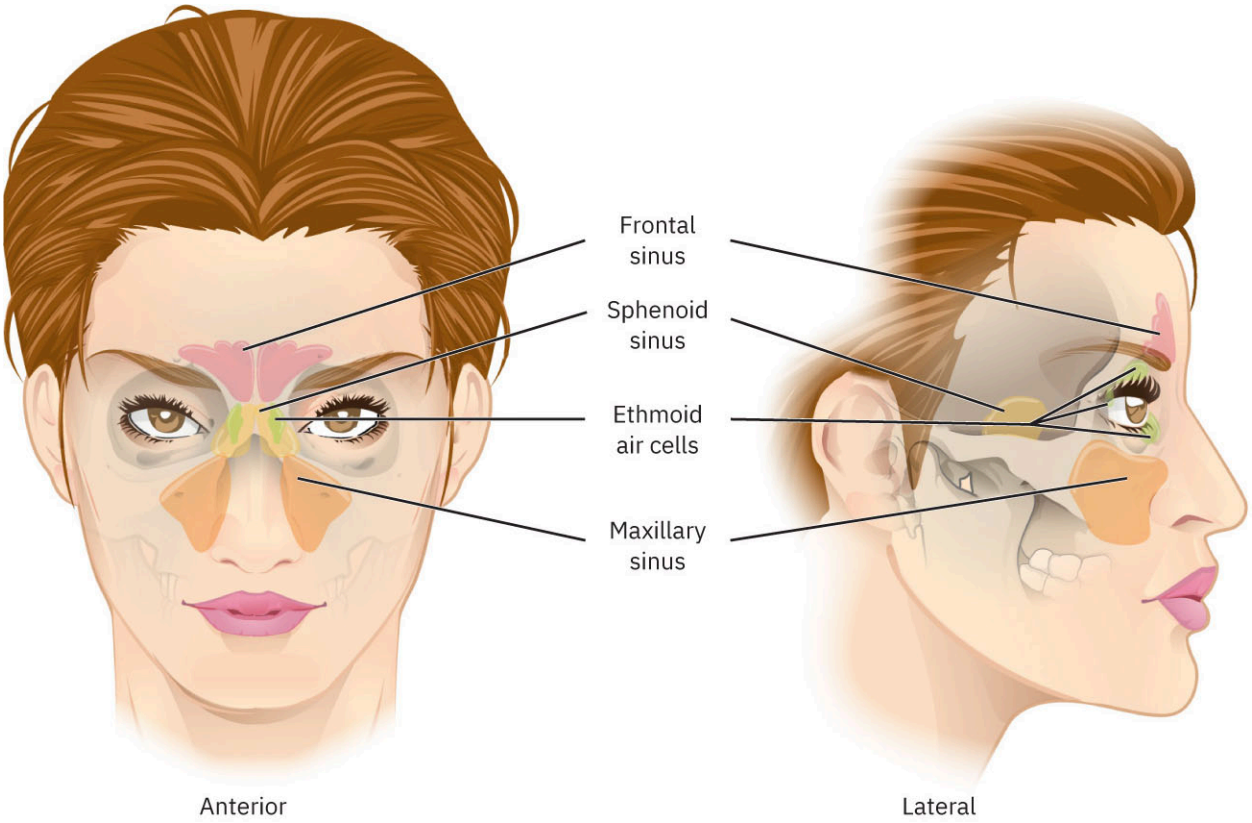


FIGURE 22.31 The paranasal sinuses are named after the bones in which they are located. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Nursing Assessment: Inspection and Palpation

Nursing assessment forms the cornerstone of effective patient care, allowing healthcare professionals to gather crucial information about a patient's health status. When it comes to the examination of the mouth, throat, nose, and sinuses, thorough inspection and palpation play vital roles in unveiling potential abnormalities and guiding appropriate interventions. Through observation and touch, nurses can identify signs of discomfort, infection, inflammation, and other issues that may affect a patient's overall well-being.

Collecting Subjective Data

Begin the mouth, throat, nose, and sinuses assessment by asking focused interview questions to determine whether the patient is currently experiencing any symptoms or has a previous medical history related to mouth, throat, nose, and sinus issues. Common interview questions to collect subjective assessment data of the mouth, throat, nose, and sinuses can be found in Table 22.4.

Interview Questions	Follow-up
Have you ever been diagnosed with a medical condition related to your mouth, such as tooth decay, gingivitis, oral thrush, or cold sores?	If yes, please describe with details such as what condition, when, frequency, symptoms, and medical treatment provided.
Have you ever been diagnosed with a medical condition related to your throat, such as strep throat, tonsillitis, pharyngitis, or gastroesophageal reflux disease (GERD)?	If yes, please describe with details such as what condition, when, frequency, symptoms, and medical treatment provided.

TABLE 22.4 Interview Questions for Subjective Assessment of the Mouth, Throat, Nose, and Sinuses

Interview Questions	Follow-up
Have you ever been diagnosed with a medical condition related to your nose or sinuses, such as sinusitis, rhinitis, nasal polyps, deviated septum, or broken nose?	If yes, please describe with details such as what condition, when, frequency, symptoms, and medical treatment provided.
Are you currently taking any medications, herbs, or supplements for allergies, sore throat, or mouth sores?	If yes, please describe what you take, dose, frequency, route, and if medication is effective.
Have you had any symptoms such as nosebleeds, nasal drainage, sinus pressure, or sore throat?	If yes, use the PQRSTU method to gather additional information regarding each symptom.
Specific oral assessment questions: • Are you having any pain, bleeding, or other problems with your teeth or gums? • Do you have any loose or sensitive teeth? • Do you experience bleeding after brushing or flossing your teeth? • Are you wearing dentures? Do they fit properly? • Are you experiencing bad breath that will not go away? • Have your eating patterns changed due to mouth pain or discomfort with chewing?	

TABLE 22.4 Interview Questions for Subjective Assessment of the Mouth, Throat, Nose, and Sinuses

LIFE-STAGE CONTEXT

Changes in Smell and Taste

Aging can bring about various changes in the senses, including smell and taste. These changes are often part of the natural aging process and can impact an individual's overall quality of life. Examples of how smell and taste can be affected by aging include the following:

Smell (olfaction):

- **Reduced sensitivity:** As people age, the number of olfactory receptors in the nose can decrease, leading to reduced sensitivity to odors.
- **Loss of discrimination:** The ability to distinguish between different smells might decline; therefore, people may find it challenging to identify subtle scents or differentiate between similar odors.
- **Impact on safety and enjoyment:** A reduced sense of smell can affect safety, as individuals may have difficulty detecting spoiled food, gas leaks, or smoke. It can also impact the enjoyment of food and the appreciation of fragrances.

Taste (gustation):

- **Decline in taste buds:** With age, the number of taste buds on the tongue may decrease, affecting the ability to taste flavors fully.
- **Diminished taste sensitivity:** Some older adults may experience reduced taste sensitivity, making it harder to detect subtle flavors like sweetness, bitterness, sourness, and saltiness.
- **Medication effects:** Certain medications can alter taste perceptions and lead to a metallic or bitter taste in the mouth, affecting the enjoyment of food.

It is important to note that not all individuals will experience the same extent of changes in smell and taste, and

some people might retain their sensory abilities well into old age. Additionally, the interaction between smell and taste means that changes in one sense can influence the other. Maintaining a balanced and nutritious diet, staying hydrated, and practicing good oral hygiene can help mitigate some of the challenges associated with changes in smell and taste.

Collecting Objective Data

During a thorough assessment of the mouth, throat, sinuses, and nose, inspection is a critical step to visually examine these structures for any abnormalities, inflammation, lesions, or signs of infection. Examination of the mouth includes assessing the lips for dryness, cracks, ulcers, or lesions. Ask the patient to open their mouth and say "Ah." This step is important because it raises the posterior palate and uvula and depresses the back of the tongue, allowing a clear view of the throat. Using a good light and tongue blade, inspect the oral mucosa, gums, cheeks, tongue, and floor of the mouth for redness, swelling, white patches, or other abnormalities. Use a gloved hand to retract the lips and cheeks to fully examine the gums and teeth. Assess the teeth for cavities, staining, decay, or missing teeth. If the patient wears dentures, remove them so you can assess the underlying mucosa. Note the color of the gums, which are normally pink. Inspect the gum margins for swelling, bleeding, or ulceration. Assess for loose teeth with a gloved thumb and index finger, and note if halitosis (bad breath) is present. Observe the tongue's color, texture, and any coating. Check for any lesions, bumps, or abnormal movements. Inspect the hard and soft palate for any growths, ulcers, or color changes. Examine the tonsils for size, redness, exudates, or tonsillar enlargement. Observe the uvula's position and any swelling or deviation. It should be midline and should rise symmetrically when the patient says "Ah." Check for any swelling or tenderness of the salivary glands, such as the parotid and submandibular glands. Assess if the patient is able to swallow their own secretions. If the patient has had a recent stroke or you have any concerns about their ability to swallow, perform a brief bedside swallow study according to agency policy before administering any food, fluids, or medication by mouth.

Examination of the throat includes using a tongue depressor and light to visualize the pharynx. Assess for redness, swelling, exudates, or any abnormalities. Gently press down on the tongue with the tongue depressor and ask the patient to say "Ah" while observing the movement of the structures.

Examination of the sinuses includes inspecting the face for any visible swelling or puffiness, especially around the eyes, which can indicate sinus congestion. Check for any tenderness, deformities, or fractures on the nasal bridge. Gently press on the sinus areas (forehead, cheeks) to assess for tenderness or pain.

Examination of the nose includes observing the external nose for any deformities, asymmetry, swelling, or skin changes. Use a nasal speculum and light to inspect the nasal passages. Look for any redness, swelling, or discharge. Inspect the nose for patency, and note any nasal drainage. Assess the nasal septum for any deviation, perforation, or bleeding. Examine the nasal turbinates for any congestion, color changes, or polyps. If there is suspicion of a nasal fracture, gentle palpation can help assess for tenderness, crepitus (crackling sensation), or deformities along the nasal bridge. In cases of suspected sinusitis or sinus discomfort, gentle palpation can be applied to the sinus areas (forehead, cheeks) to check for tenderness, which can indicate inflammation.

Validating and Documenting Findings

Validating and documenting assessment findings of the mouth, throat, nose, and sinuses are essential steps in the nursing process, ensuring accurate communication and informed decision-making. Validation involves cross-referencing subjective and objective findings to ensure the data collected are reliable and accurate. Data may be validated by repeating the assessment, asking additional questions to clarify data, and comparing the objective findings with the subjective findings to determine if any discrepancies are present. For example, additional assessment and questioning may be warranted if the patient reports brushing their teeth twice daily, however, poor dentition, plaque, and bad breath are noted.

Documentation provides a clear record of the patient's condition for future reference and collaboration among healthcare providers. Documentation should include both subjective and objective data. Table 22.5 provides examples for documenting subjective and objective findings.

Subjective Data	Objective Data
Collected by asking the patient about their health history	Collected through the physical assessment
Include direct quotes when possible	Include the facts
Examples of documentation: "Patient reports sinus pressure and nasal congestion lasting four days." "Patient reports history of cold sores." "Patient reports brushing teeth twice daily." "Patient complains of sore throat 'that feels like swallowing razor blades' for the past two days."	Examples of documentation: "Oral mucosa is pink and moist." "Tonsils are symmetrical, no swelling or exudates observed." "Uvula is midline position, no swelling or deviation noted." "No tenderness noted upon gentle palpation of sinus areas."

TABLE 22.5 Documenting Subjective and Objective Data

Abnormalities of the Mouth, Throat, Nose, and Sinuses

When conducting a health assessment, it is important to be able to recognize abnormalities of the mouth, throat, nose, and sinuses. These regions are not only central to our ability to breathe, speak, and consume food, but they also provide insights into our overall well-being. Abnormalities of the mouth, throat, nose, and sinuses encompass a diverse range of conditions, from common issues to more complex medical concerns. Identifying abnormalities allows healthcare professionals to detect potential issues early, enabling timely intervention and treatment.

Abnormalities of the Mouth and Throat

Abnormalities of the mouth and throat can encompass a wide range of conditions, each with its own causes, symptoms, and implications. These abnormalities can result in various symptoms, including pain, difficulty swallowing, hoarseness, and in some cases, life-threatening conditions. Accurate assessment and appropriate intervention by nurses is essential for managing and mitigating these conditions.

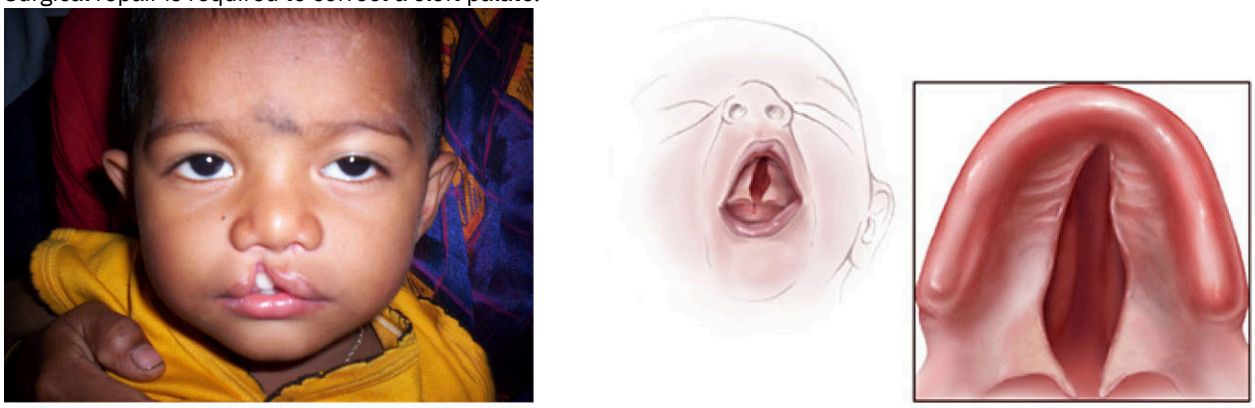
Mouth Abnormalities

Some common abnormalities that can be observed during a physical examination of the mouth include the following:

- Oral ulcer: A painful sore on the lips, tongue, gums, or inside the cheeks, called an oral ulcer can be caused by conditions like oral herpes, aphthous stomatitis, or infections.
- Leukoplakia: Thickened, white patches on the oral mucosa, called **leukoplakia**, may be a sign of irritation, fungal infections, or precancerous lesions.
- Erythroplakia: Red patches on the oral mucosa that do not heal, called **erythroplakia**, may indicate potential precancerous changes or oral cancer.
- Candidiasis (thrush): A fungal infection that appears as white patches that can be scraped off is called **candidiasis (also, thrush)**; it is often seen in immunocompromised individuals (Figure 22.32).

FIGURE 22.32 Candidiasis (oral thrush) is a fungal infection that results in white patches on the tongue and in the mouth. Treatment includes antifungal medications (such as clotrimazole, miconazole, or nystatin), proper oral hygiene, and managing underlying conditions. (credit: "Clinical photograph showing typical presentation of oral thrush (white curdy patches in dorsum of tongue)" by National Library of Medicine, CC BY 2.0)

- Oral cancer: Lesions that do not heal, bleeding, changes in color, or lumps can be signs of oral cancer. Oral cancer often forms on the floor of the mouth, under the tongue.
- Cleft lip: A **cleft lip** is a birth defect that involves a partial or complete failure of the right and left portions of the upper lip to fuse together, leaving a cleft (gap) (Figure 22.33a).
- Cleft palate: A **cleft palate** is a birth defect resulting from a failure of the two halves of the hard palate to completely come together and fuse at the midline, thus leaving a gap between the nasal and oral cavities (Figure 22.33b). Because of the communication between the oral and nasal cavities, a cleft palate makes it very difficult for an infant to generate the suckling needed for nursing, thus creating risk for malnutrition. Surgical repair is required to correct a cleft palate.



(a) **(b)**

FIGURE 22.33 (a) A cleft lip is caused by failure of the lips to fuse together; (b) a cleft palate is caused by failure of the hard palate to fuse together. (credit a: modification of work “Cleft lip child” by “Raj d0509”/Wikimedia Commons, Public Domain; credit b: modification of work “Cleft palate” by Centers for Disease Control and Prevention/Wikimedia Commons, CC BY 1.0)

Other abnormalities of the mouth relate to poor oral health. Poor oral health can manifest in various signs and symptoms, indicating potential issues with dental hygiene, gum health, and overall oral well-being. Common signs of poor oral health include the following:

- Halitosis: Persistent bad breath, even after brushing and using mouthwash, is known as **halitosis**; it can be a sign of oral health problems like gum disease or cavities.
- Tooth decay: Visible cavities or holes in the teeth, along with sensitivity to hot, cold, or sweet foods, can

indicate **tooth decay**.

- Gum disease: Gums that bleed when brushing or flossing are often an early sign of **gum disease**. Inflammation of the gums can indicate gingivitis or more advanced periodontal disease. Gums that pull away from the teeth, exposing the tooth roots, are a sign of gum recession and potential periodontal problems.
- Tooth sensitivity: Sharp pain or discomfort, **tooth sensitivity**, when consuming hot, cold, sweet, or acidic foods and beverages can indicate enamel erosion or gum recession.
- Tooth mobility: If teeth feel loose or shift position, showing **tooth mobility**, it could be due to advanced gum disease affecting the tooth-supporting structures.
- Persistent toothache: Unexplained and **persistent toothache** can be a sign of infection or decay.
- Discolored teeth: Stained or discolored teeth, especially in the absence of lifestyle factors like coffee or tobacco use, could indicate poor oral hygiene or other issues.
- Dry mouth: Reduced saliva production can lead to **dry mouth**, which increases the risk of tooth decay and gum problems.
- Foul taste: A persistent foul taste in the mouth, even after brushing, can be a sign of underlying oral health problems.

Maintaining good oral hygiene practices, including regular brushing, flossing, and dental checkups, can help prevent these signs of poor oral health. Because many Americans lack access to oral care, it is important for nurses to perform routine oral assessment and identify needs for follow-up. If signs and/or symptoms indicate potential oral disease, the patient should be referred to a dental health professional for a more thorough evaluation.

Throat Abnormalities

The following are some common abnormalities that can be observed during a physical examination of the throat:

- Enlarged tonsils: There are four main types of tonsils: the palatine tonsils (located laterally between the palatoglossal arch and the palatopharyngeal arch), pharyngeal tonsils (known as adenoids; located at the superior part of the nasopharynx), lingual tonsils (located at the posterior base of the tongue), and tubal tonsils (located posterior to the pharyngeal opening of the auditory tube in the nasopharynx). Infections like tonsillitis or chronic inflammation can cause **enlarged tonsils**. Tonsil grading involves a systematic evaluation of the tonsils' size, ranging from 0 to 4+ (Figure 22.34). Grade 0 indicates previous tonsillectomy, grade 1 indicates normal size, grade 2 indicates mild enlargement, grade 3 indicates moderate enlargement, and grade 4 indicates severe enlargement.

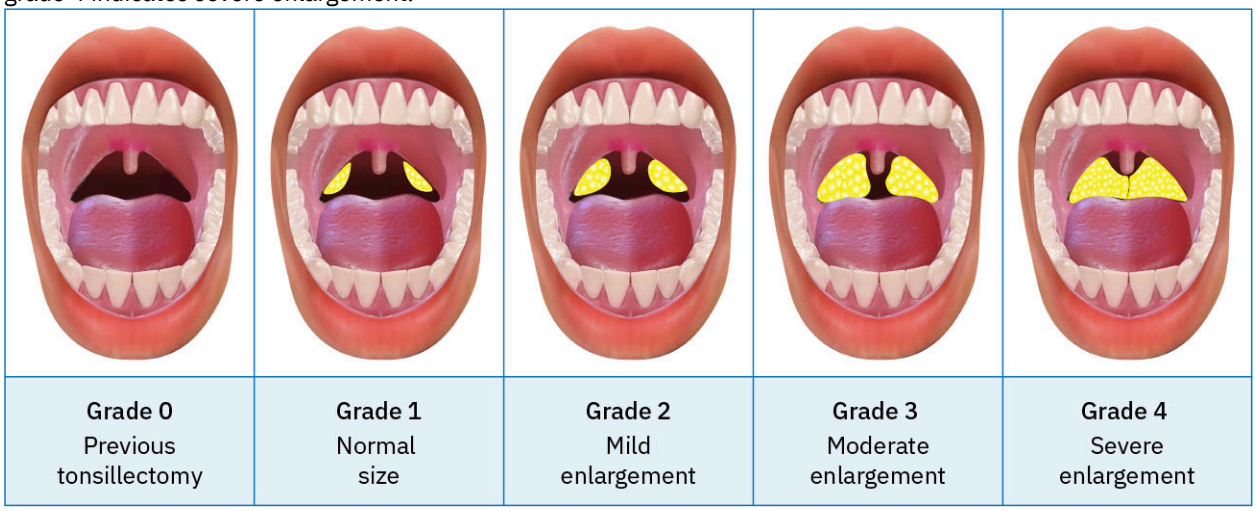


FIGURE 22.34 Tonsillar grading is based on the location of the tonsils in comparison to the uvula pillars. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

- Tonsillar exudates: White or yellow patches on the tonsils, called **tonsillar exudate** can indicate bacterial infections like strep throat.
- Pharyngitis: Redness, swelling, and discomfort in the pharynx can be due to viral or bacterial infections. Common causes of **pharyngitis** are the cold viruses, influenza, strep throat caused by group A streptococcus, and mononucleosis. Strep throat typically causes white patches on the tonsils with a fever and enlarged lymph nodes. It must be treated with antibiotics to prevent potential complications in the heart and kidneys.

- Peritonsillar abscess: A **peritonsillar abscess** is a collection of pus behind the tonsils that can cause severe sore throat, difficulty swallowing, and voice changes.
- Laryngitis: In **laryngitis**, there is inflammation of the vocal cords causing hoarseness, loss of voice, or changes in voice quality.
- Epiglottitis: The condition **epiglottitis** involves swelling of the epiglottis causing difficulty breathing, pain, and a muffled voice; it requires immediate medical attention.
- Gastroesophageal reflux disease (GERD): Chronic acid reflux, **gastroesophageal reflux disease (GERD)** can lead to irritation of the throat, causing hoarseness, cough, and throat discomfort.
- Throat cancer: Persistent throat pain, difficulty swallowing, hoarseness, or changes in voice can indicate throat cancer.

Other abnormalities of the throat include difficulty swallowing. Dysphagia is the medical term for difficulty swallowing that can be caused by many medical conditions. Nurses are often the first healthcare professionals to notice a patient's difficulty swallowing as they administer medications or monitor food intake. Signs of dysphagia include coughing during or right after eating or drinking, wet or gurgly sounding voice during or after eating or drinking, extra effort or time required to chew or swallow, food or liquid leaking from mouth, food getting stuck in the mouth, and difficulty breathing after meals. Early identification of dysphagia, especially after a patient has experienced a cerebrovascular accident (e.g., stroke) or other head injury, helps to prevent aspiration pneumonia. Aspiration pneumonia is a type of lung infection caused by material from the stomach or mouth entering the lungs, and this can be life threatening. If dysphagia is suspected, a bedside swallow screening can be conducted to determine if clinical signs and symptoms that may be indicators of dysphagia are present. If the patient fails the bedside swallow screen, they should remain nothing by mouth (NPO) until further evaluation by a speech therapist.

LINK TO LEARNING

A demonstration of how to perform a bedside swallow screen (https://openstax.org/r/77BedSwalScreen) is provided in this video.

Abnormalities of the Nose and Sinuses

In **epistaxis**, commonly known as a **nosebleed**, there is bleeding from the blood vessels within the nasal passages. It is a relatively common condition that can occur in people of all ages. Nosebleeds can range from mild to more severe and can be caused by various factors, such as dry air, nasal trauma, nasal irrigation (such as allergies, sinus infections, exposure to irritants like smoke or chemicals), overuse of nasal decongestant sprays, blood-thinning medications (like aspirin, anticoagulants, and antiplatelets), nasal polyps, hypertension, or foreign objects being inserted into the nose. To treat a nosebleed, encourage the individual to stay calm (as anxiety can worsen the bleeding), have them sit upright and lean forward slightly (to avoid swallowing blood), pinch the soft part of the nostrils together, and instruct them to breathe through the mouth for about ten to fifteen minutes. Applying a cold compress to the nose and forehead can help constrict blood vessels and slow bleeding. Using a humidifier can help prevent nasal dryness, reducing the risk of further bleeding. Advise the individual to avoid activities that can further irritate the nose, such as picking or blowing the nose forcefully. Continued bleeding may require vasoconstrictor nose spray, cautery with silver nitrate, topical sealants or glue, nasal packing, or balloon catheters.

A **deviated septum** is a common medical condition where the thin wall (nasal septum) that separates the two nasal passages is displaced or shifted to one side. This displacement can be present from birth or can result from injury or trauma to the nose. A deviated septum can cause one nasal passage to be narrower than the other, potentially affecting airflow through the nose. Symptoms of a deviated septum include nasal obstruction (one side of the nose may have reduced airflow), nasal congestion (chronic nasal congestion on one side), recurrent sinus infections (due to poor drainage), nosebleeds (due to dryness and irritation caused by airflow imbalance), and sleep disturbances (disruption in sleep and snoring). For mild cases with minimal symptoms, treatment may not be necessary. However, for more severe cases that cause significant discomfort or breathing difficulties, treatment options may include over-the-counter decongestants or nasal sprays or surgical correction, known as septoplasty.

REAL RN STORIES

Nasogastric Tube Issue

Nurse: Marcia, RN
Clinical setting: Medical-surgical inpatient unit
Years in practice: 9
Facility location: Seattle, Washington

I was caring for a patient with a small bowel obstruction who needed a nasogastric (NG) tube placed for bowel decompression. I checked patency of both nares and found the right nare to be the most patent. I got all of my supplies ready and went to insert the NG tube in the right nare, without success. After a second failed attempt, I attempted to insert it into the left nare. Another failed attempt. We let the patient rest for a little bit, and then I asked my charge nurse to try to insert it, who was also unsuccessful. After consulting with the provider, an order was placed for the NG tube to be placed by the radiology department. Come to find out, the patient had an undiagnosed deviated septum, making it extremely difficult to insert the NG tube.

The medical diagnosis for inflamed sinuses that can be caused by a viral or bacterial infection is **sinusitis**. When the nasal membranes become swollen, the drainage of mucous is blocked and causes pain. There are several types of sinusitis:

- acute sinusitis: infection lasting up to four weeks
- chronic sinusitis: infection lasting more than twelve weeks
- recurrent sinusitis: several episodes of sinusitis within a year

Symptoms of sinusitis can include fever, weakness, fatigue, cough, and congestion. There may also be mucus drainage in the back of the throat, called postnasal drip. Healthcare providers diagnose sinusitis based on symptoms and an examination of the nose and face. Treatments include antibiotics, decongestants, and pain relievers.

Other abnormalities of the nose include the following:

- Nasal polyps: A **nasal polyp** is a noncancerous growth that develops inside the nasal passages or sinuses. Nasal polyps can cause nasal congestion, difficulty breathing, and reduced sense of smell.
- Rhinitis: Allergic **rhinitis** and nonallergic rhinitis involve inflammation of the nasal passages, leading to symptoms like sneezing, runny or stuffy nose, and itching.
- Nasal fractures: Trauma to the nose can result in a nasal fracture, causing deformities, pain, and breathing difficulties.
- Nasal congestion: Chronic nasal congestion can be caused by various factors, including allergies, infections, or structural issues.
- Nasal obstruction: Any nasal obstruction or blockage that hinders airflow through the nasal passages can cause breathing difficulties.
- Nasal discharge: Unusual or persistent nasal discharge can be a sign of infections, allergies, or other underlying conditions.
- Nasal deformities: Various congenital or acquired conditions can lead to structural nasal deformity

Treatment options for these conditions vary depending on the specific condition and its impact on breathing, comfort, and overall health.

Summary

22.1 Head and Neck

The head contains the skull, brain, and face. Common functions of the head include eating, breathing, and communication. The head houses the brain and sensory organs responsible for vision, hearing, smell, taste, and touch. The neck contains muscles, vertebrae, blood vessels, the thyroid gland, and lymph nodes. The neck is a vital region of the body that supports head movement, breathing, swallowing, communication, circulation, and immune responses.

Nursing assessment of the head and neck includes inspecting and palpating structures of the head, face, and neck. Subjective data collected from the patient and objective data collected through the assessment should be verified and documented appropriately.

Abnormalities of the head and neck include conditions such as headache, concussion, head injury, acromegaly, Cushing syndrome, scleroderma, Bell palsy, myxedema, and simple goiters.

22.2 Eyes

External structures of the eye include the eyebrows, eyelids, eyelashes, conjunctiva, cornea, sclera, iris, pupil, lacrimal gland, and lacrimal ducts. Internal structures of the eye include the lens, ciliary muscle, vitreous humor, retina, cones, rods, macula, optic nerve, and optic disc. The primary function of the eyes is to enable vision. Key elements of vision include visual fields, visual pathways, and visual reflexes.

The nursing assessment includes inspecting the eyes by assessing the pupils, visual acuity, extraocular movements, and peripheral vision. Objective and subjective findings should be validated to ensure accuracy prior to documenting the findings.

Abnormalities of the external eye include conditions such as conjunctivitis, stye, chalazion, ptosis, ectropion, and exophthalmos. Abnormalities of the internal eye include conditions such as pterygium, corneal abrasions and scars, cataracts, irregularly shaped iris, mydriasis, anisocoria, miosis, papilledema, glaucoma, optic atrophy, and macular degeneration. Visual abnormalities include conditions such as myopia, hyperopia, astigmatism, presbyopia, color blindness, amblyopia, strabismus, diplopia, floaters, flashes, photophobia, night blindness, and halos.

22.3 Ears

The ear consists of three main parts: the outer ear, the middle ear, and the inner ear. The external ear is composed of the pinna (auricle) and the external auditory canal. The middle ear is composed of the eardrum (tympanic membrane), ossicles, and eustachian tube. The inner ear is composed of the cochlea and the vestibular system. The ear functions to enable hearing and maintain balance.

Nursing assessment of the ear involves collecting subjective and objective data. Subjective data can be obtained by asking the patient about factors such as symptoms, hearing changes, ear pain, medications, occupational and recreational exposures, and personal habits. Objective data can be obtained by inspecting and palpating the external ear, inspecting the ear canal and tympanic membrane, conducting hearing tests, as well as performing balance and equilibrium assessments.

Abnormalities of the ear can often lead to hearing loss, tinnitus, and vertigo. Abnormalities of the external ear and canal include conditions such as microtia, macrotia, Stahl ear, cauliflower ear, otitis externa, earwax impaction, foreign bodies in the ear canal, and ear tags. Abnormalities of the middle ear include conditions such as perforated eardrums, tympanosclerosis, tympanic membrane retraction, myringitis, otitis media, and foreign bodies in the ear. Abnormalities of the inner ear include conditions such as sensorineural hearing loss, Ménière disease, labyrinthitis, and inner ear trauma.

22.4 Mouth, Throat, Nose, and Sinuses

The mouth is located at the opening of the digestive and respiratory tracts and is composed of lips, teeth, jaws, tongue, palate, uvula, and salivary glands. Functions of the mouth include eating, tasting, speaking, initiating digestion, and speech.

The throat is a muscular tube that connects the nasal cavity and mouth to the larynx and the esophagus. Functions of the throat include breathing, swallowing, speech production, and protection of the airway.

The nose is composed of the nasal bridge, nostrils, nasal cavities, nasal septum, and turbinates. Functions of the nose include facilitating breathing, detecting smells, influencing speech, contributing to immune defense, and aiding in temperature regulation.

Sinuses are a group of air-filled spaces within the bones of the face and skull, located around the nose and above the eyes, that connect to the nasal cavity. Functions of the sinuses include insulating the skill, adding warmth and humidity to the air that is breathed in, producing mucus, and adding voice resonance.

Nursing assessment of the mouth, throat, nose, and sinuses involves collecting subjective data through a series of questions, as well as objective data by performing a nursing assessment using inspection and palpation methods. Comparing subjective and objective data helps to ensure data collected and documented are reliable and accurate.

Abnormalities of the mouth may include conditions such as oral ulcers, leukoplakia, erythroplakia, thrush, oral cancer, cleft lip, cleft palate, halitosis, tooth decay, gum disease, dry mouth, tooth mobility, toothache, and discolored teeth. Abnormalities of the throat may include conditions such as enlarged tonsils, tonsillar exudate, pharyngitis, laryngitis, epiglottitis, GERD, throat cancer, and dysphagia. Abnormalities of the nose and sinuses may include conditions such as epistaxis, deviated septum, sinusitis, nasal polyps, rhinitis, fracture, congestion, obstruction, discharge, and nose deformities.

Key Terms

acromegaly rare hormonal disorder that occurs when the pituitary gland produces an excessive amount of growth hormone (GH)
adenoids lymphoid tissue that traps and destroys invading pathogens that enter during inhalation
adenoma noncancerous tumor
amblyopia (also, lazy eye) reduced vision in one eye due to improper development
anisocoria unequal pupil sizes in both eyes
astigmatism blurred or distorted vision due to an irregularly shaped cornea or lens
autoimmune disease occurs when the body's immune system attacks healthy cells and tissues
Bell palsy neurological disorder characterized by the sudden onset of facial muscle weakness or paralysis
candidiasis (also, thrush) fungal infection that appears as white patches
cataract clouding of the eye's natural lens
cauliflower ear deformed ear, resembling cauliflower, due to repeated trauma to the ear
cerumen earwax
cervical vertebrae series of seven small bones that make up the upper part of the vertebral column, also known as the spine
chalazion noninfectious bump on the eyelid caused by a blocked oil gland
ciliary muscle controls the shape of the lens to help with focusing on near and distant objects
cleft lip birth defect that involves a partial or complete failure of the right and left portions of the upper lip to fuse together, leaving a cleft (gap)
cleft palate birth defect resulting from a failure of the two halves of the hard palate to completely come together and fuse at the midline, thus leaving a gap between the nasal and oral cavities
cochlea snail-shaped, fluid-filled structure responsible for converting sound vibrations into electrical signals that the brain can interpret as sound
color blindness difficulty distinguishing certain colors, often red and green or blue and yellow
concussion a type of traumatic brain injury (TBI) that occurs when the brain experiences a sudden and forceful movement within the skull
conductive hearing loss occurs when something in the external or middle ear is obstructing the transmission of sound
cone photoreceptor that is primarily responsible for color vision and visual acuity
congenital ear pit small depression near the external ear present at birth
congenital ear tag small piece of extra tissue present at birth
conjunctiva thin, transparent membrane covering the front surface of the eye

conjunctivitis (also, pink eye) inflammation of the conjunctiva
connective tissue disease disorder affecting tissues such as skin, tendons, and cartilage
cornea clear, dome-shaped front surface of the eye
corneal abrasion scratch or injury to the cornea's surface
corneal scar tissue that forms after the healing of a deep eye injury
Cushing syndrome (also, hypercortisolism) characterized by an excessive and prolonged exposure to high levels of the hormone cortisol
deviated septum thin wall (nasal septum) that separates the two nasal passages is displaced or shifted to one side
diplopia seeing two images of a single object
dry mouth reduced saliva production
earwax impaction a buildup of earwax (cerumen)
ectropion outward turning of the lower eyelid
enlarged tonsils swollen tonsil
epiglottis a flexible piece of cartilage that covers the opening of the trachea during swallowing to prevent ingested material from entering the trachea
epiglottitis inflammation of the epiglottis
epistaxis (also, nosebleed) bleeding from the blood vessels within the nasal passages
erythroplakia red patches on the oral mucosa
ethmoid bone bone located between the eye sockets and forms part of the nasal cavity
eustachian tube connects the middle ear to the back of the nose
exophthalmos bulging or protruding eyeballs
external auditory canal a tubelike structure that connects the pinna to the eardrum
external ear composed of pinna (auricle) and external auditory canal
extraocular movement movement of the eye that is controlled by a group of muscles surrounding each eye
eyebrow the hair-covered ridge above the eye that helps protect the eye from sweat and direct sunlight
eyelashes short hairs along the eyelid edge that helps prevent debris from entering the eye
eyelid the movable fold of skin and muscle that covers and protects the front of the eye
facial drooping an asymmetrical facial expression that occurs due to damage of the nerve
flash brief, flickering light or sensation that occurs in the visual field
floater small, semitransparent spot or shape that appears to "float" in the field of vision
foul taste bad taste in the mouth
frontal bone bone that forms the forehead and the upper portion of the eye sockets
gastroesophageal reflux disease (GERD) condition resulting from chronic acid reflux
glaucoma a group of eye disorders characterized by increased intraocular pressure that damages the optic nerve, causing gradual peripheral vision loss and potential blindness
gum disease infection of the tissues that hold the teeth in place
gustation taste
halitosis persistent foul-smelling or bad breath
halo glowing circle or ring around a light source
headache a common and uncomfortable sensation of pain or discomfort in the head or upper neck area
hordeolum (also, stye) painful, localized infection or inflammation of an eyelid gland
hyperopia (also, farsightedness) distant objects are clearer than close ones
inner ear composed of the cochlea and the vestibular system
inner ear trauma trauma to the head or ears that results in inner ear damage
iris colored part of the eye
labyrinthitis inflammation of the inner ear
lacrimal duct drains tears from the eye's surface to the nasal cavity
lacrimal gland produces tears that keep the eye moist
laryngitis inflammation of the larynx (vocal cords)
larynx tubular airway structure at the superior part of the trachea that connects the pharynx to the trachea and helps regulate the volume of air that enters and leaves the lungs; contains the vocal cords
lens transparent, flexible structure located behind the iris

leukoplakia thickened, white patches on the oral mucosa
levator scapulae muscle located along the side of the neck
linear scleroderma a line of scleroderma
macrotia abnormally large ears compared to typical proportions
macula small, central area of the retina responsible for central vision and color perception
macular degeneration gradual and progressive damage to the macula
mandible lower jaw bone
mastoid process bony prominence behind the ear
maxilla upper jaw bone
Ménière disease disorder of the inner ear characterized by episodes of vertigo (spinning sensation), fluctuating hearing loss, tinnitus (ringing in the ears), and a feeling of fullness or pressure in the ear
microtia a congenital condition where the external ear is underdeveloped or absent
miosis abnormal constriction of the pupil
morphea patches of scleroderma
mydriasis pupil dilation
myopia (nearsightedness) distant objects appear blurry while close objects are clear
myringitis inflammation of the eardrum
myxedema severe form of hypothyroidism that occurs when the thyroid gland does not produce enough thyroid hormones
nasal polyp noncancerous growth that develops inside the nasal passages or sinuses
nasal septum internal wall, composed of bone and cartilage, that divides the nose into left and right nostrils
night blindness difficulty seeing in low-light conditions
nystagmus an involuntary, rhythmic, back-and-forth movement of the eyes
occipital bone bone that forms the back and base of the cranium
olfaction smell
optic atrophy degeneration of the optic nerve fibers
optic disc the area where the optic nerve exits the retina
optic nerve the bundle of nerve fibers that carries visual information from the retina to the brain for processing
orbit bony socket that houses the eyeball and the muscles that move the eyeball
otitis externa (also, "swimmer's ear") an infection or inflammation of the external ear canal, usually caused by water exposure or bacterial/fungal infections
otitis media (also, middle ear infection) Eustachian tube becomes inflamed and the middle ear fills with fluid, causing ear pain and irritability
papilledema swelling of the optic disc at the back of the eye due to increased intracranial pressure
paranasal sinuses a group of air-filled spaces within the bones of the face and skull, located around the nose and above the eyes
parietal bones bones that form the majority of the upper sides and the roof of the cranium
perforated eardrum a hole or tear in the tympanic membrane
peripheral vision ability to perceive objects, movement, and light outside the central area of focus
peritonsillar abscess a collection of pus behind the tonsils that can cause severe sore throat, difficulty swallowing, and voice changes
persistent toothache toothache that will not go away
pharyngitis inflammation of the pharynx
pharynx muscular tube that connects the nasal cavity and mouth to the voice box (larynx) and the esophagus (food pipe); also known as the throat
photophobia sensitivity to light
presbycusis sensorineural hearing loss that occurs with aging due to gradual nerve degeneration
presbyopia age-related difficulty in focusing on close objects
pterion point where the frontal, parietal, sphenoid, and temporal bones meet
pterygium a growth of tissue on the conjunctiva that can extend onto the cornea
ptosis drooping of the upper eyelid
pupil black circular opening in the center of the iris
Raynaud phenomenon a condition that causes pale or blue fingers with cold exposure

retina innermost layer of the eye that contains photoreceptors (rods and cones)
rheumatic disease condition that primarily affects the joints, muscles, and bones
rhinitis inflammation of the nasal passages
Rinne test clinical test that compares air conduction (AC) and bone conduction (BC) to assess whether hearing loss is due to conductive or sensorineural factors
rod photoreceptor that is responsible for vision in low-light conditions and for detecting movement
Romberg test clinical assessment used to assess balance
scalene muscles muscles located on the side of the neck
sclera white, tough outer covering of the eye
scleroderma (also, systemic sclerosis) a chronic, autoimmune disorder that causes inflammation in the skin
sensorineural hearing loss hearing loss caused by pathology of the inner ear, cranial nerve VIII, or auditory areas of the cerebral cortex
simple goiter (also, endemic goiter) noncancerous enlargement of the thyroid gland that results in visible swelling of the neck
sinusitis inflammation of the sinuses
sphenoid bone bone that sits at the base of the skull
Stahl ear (also, "Spock ear") condition involves a pointed or elflike appearance of the upper part of the ear due to an extra fold
stapes (also, stirrup) the smallest bone in the human body; transmits vibrations from the incus to the oval window of the cochlea
sternocleidomastoid muscle that runs diagonally from the base of the skull behind the ear to the sternum and clavicle
strabismus misalignment of the eyes causing one eye to turn inward, outward, upward, or downward while the other eye remains focused
sutures fibrous joints that connect the bones of the skull
temporal bones bones located on the sides and base of the skull
thyroid a butterfly-shaped endocrine gland located in the front of the neck, just below the Adam's apple (thyroid cartilage)
tinnitus ringing, buzzing, or hissing sounds in the ears
tonsillar exudate white or yellow patches on the tonsils
tooth decay visible cavities or holes in the outer surface of a tooth or enamel
tooth mobility teeth feel loose or shift position
tooth sensitivity sharp pain or discomfort when consuming hot, cold, sweet, or acidic foods and beverages
trapezius large muscle that extends from the base of the skull down to the upper back
traumatic brain injury (TBI) damage to the brain caused by a sudden, external force or trauma
turbinates a bony structure covered in mucous membrane that protrudes into a nasal cavity and helps to humidify and filter the air
tympanic membrane retraction the eardrum is pulled or retracted into the middle ear
tympanosclerosis involves the formation of thickened or scarred areas on the eardrum due to repeated infections or inflammation
vertigo sensation of spinning or dizziness
vestibular system composed of the semicircular canals and the vestibule
visual acuity measures a person's ability to see details at a specific distance
visual field area that an individual can see when their gaze is fixed straight ahead
visual reflex automatic and involuntary response of the eyes and the body to visual stimuli
vitreous humor a gel-like substance that fills the space within the eye
Weber test clinical test used to determine whether hearing loss is present in one ear or if it is roughly equal in both ears
zygomatic bone cheekbone

Assessments

Review Questions

1. On assessment, the nurse notes the patient has an enlarged nose, protruding jaw, and prominent forehead.

The patient reports joint pain, headaches, and recent vision changes. The nurse concludes the patient is most likely experiencing what condition?

a. acromegaly
b. myxedema
c. Cushing syndrome
d. Raynaud phenomenon

2. The nurse is caring for a patient newly diagnosed with a simple goiter. What intervention should the nurse expect the provider to order?

a. thyroid-stimulating hormone
b. dietary changes to increase iodized salt intake
c. surgical removal of the goiter
d. chemotherapy

3. The nurse is performing an assessment of the patient's head and neck. What question should the nurse ask to collect objective data?

a. "Have you had a headache, dizziness, or neck pain?"
b. "On a scale of zero to ten, how would you rate your pain?"
c. "Have you ever had a stroke, concussion, or head injury?"
d. "May I feel around your neck and behind your ears?"

4. The nurse recalls that Cushing syndrome is a condition created by what body organ?

a. adrenal gland
b. hypothalamus gland
c. pituitary gland
d. thyroid gland

5. The nurse is performing an assessment on a 17-year-old patient who was thrown from a four-wheeler. What symptom is the most concerning and would require the nurse to take immediate action?

a. dizziness
b. palpable mass and swelling
c. sensitivity to light
d. severe headache

6. The nurse is performing a visual acuity test. What interpretation demonstrates an accurate understanding of the results?

a. Visual acuity of 20/50 means the patient can see at 20 feet what a person with normal vision can see at 50 feet.
b. Visual acuity of 20/40 means the patient can see at 40 feet what a person with normal vision can see at 20 feet.
c. Visual acuity of 20/40 means the patient can see 20 percent of the items that are 40 feet away.
d. Visual acuity of 20/50 means the patient can see 50 percent of the items that are 20 feet away.

7. The nurse is performing an assessment of the eyes. What action accurately describes how to perform an eye assessment?

a. To test convergence, ask the patient to keep their head still and follow a target (your fingertip or a pen) with their eyes only in all six cardinal directions.
b. To test extraocular movements, ask the patient to focus on an object (e.g., your fingertip) held about 2 inches in front of their nose, while slowly moving the object toward the patient's nose.
c. To assess the pupils, hold the penlight or flashlight about 5 to 10 inches away from the patient's face and shine the light directly into one eye; observing both pupils for their initial size and equality.
d. To test pupil accommodation, ask the patient to focus on a near object (e.g., your finger) and then switch their focus to a distant object.

8. The nurse is reviewing the structures of the eye with a newly graduated nurse. What statement made by the newly graduated nurse would warrant further education?
   a. "Rods are photoreceptors that are responsible for vision in low-light conditions and for detecting movement."
   b. "The optic nerve is the bundle of nerve fibers that carries visual information from the retina to the brain for processing."
   c. "The cornea is a small, central area of the retina responsible for central vision and color perception."
   d. "The retina is the innermost layer of the eye that contains photoreceptors, which detect light and transmit visual signals to the brain."

9. The nurse is performing an eye assessment on an 86-year-old patient who reports gradual changes in vision. The patient reports, "It looks like I'm looking through the end of a paper towel roll, but everything is blurry." The nurse recognizes the patient is most likely experiencing what eye abnormality?
   a. cataracts
   b. glaucoma
   c. macular degeneration
   d. presbyopia

10. The nurse is performing an eye assessment on a 40-year-old patient and notices the pupils are unequal in size. How would the nurse denote this eye abnormality in the patient's chart?
   a. amblyopia
   b. anisocoria
   c. miosis
   d. ptosis

11. Upon assessment, the nurse notes the patient's ear is elflike in shape. How would the nurse document this ear abnormality?
   a. cauliflower ear
   b. ear tag
   c. microtia
   d. Stahl ear

12. The nurse suspects the patient may be experiencing a perforated eardrum. What assessment would be used to determine if this prediction is accurate?
   a. Weber test
   b. inspection with otoscope
   c. Rinne test
   d. Romberg test

13. The nurse is precepting a newly graduated nurse. What statement made by the newly graduated nurse demonstrates an accurate understanding of symptoms related to ear abnormalities?
   a. "Vertigo is characterized by ringing or buzzing in the ears."
   b. "Individuals working around loud environmental hazards are at risk for tinnitus."
   c. "Vertigo can be caused by several factors, such as ototoxic medications."
   d. "Tinnitus can be treated with medications to manage the symptoms."

14. The nurse is educating a patient on hearing loss. What statement made by the patient demonstrates an accurate understanding of the teaching?
   a. "Conductive hearing loss is caused by pathology of the inner ear, cranial nerve VIII, or auditory areas of the cerebral cortex."
   b. "Ototoxic medications can also cause conductive hearing loss by affecting the hair cells in the cochlea."
   c. "Presbycusis is a sensorineural hearing loss that occurs with aging due to gradual nerve degeneration."
   d. "Sensorineural hearing loss occurs when something in the external or middle ear is obstructing the

transmission of sound."

15. The nurse is performing a Weber and Rinne test to assess hearing loss. What statement demonstrates a correct interpretation of the test results?
   a. If the patient hears the sound longer through air conduction than through BC, it is considered a negative Rinne and suggests conductive hearing loss in that ear.
   b. If the patient hears the sound equally or longer through bone conduction than through AC, it is considered a positive Rinne and suggests normal or sensorineural hearing in that ear.
   c. If the patient hears the sound equally in both ears during the Weber test, the patient has normal hearing in both ears.
   d. If the patient hears the sound louder in one ear during the Weber test, it may suggest hearing loss in both ears.

16. The nurse is caring for a 9-year-old patient who presents with epistaxis. The nurse should instruct the patient to take what action?
   a. apply a cold compress to the nose
   b. blow the nose to remove excess bloody residue
   c. breathe through their nose
   d. tilt their head back

17. The nurse is performing a throat assessment and would like to inspect the tonsils. Where are the tonsils located?
   a. nasopharynx and laryngopharynx
   b. nasopharynx and oropharynx
   c. oropharynx and laryngopharynx
   d. laryngopharynx

18. During an examination of the oral cavity, what technique by the nurse is most appropriate to examine the gums and teeth?
   a. Ask the patient to open their mouth and say "ah."
   b. Use a penlight and tongue depressor to retract the lips.
   c. Use a gloved hand to retract the lips and cheeks.
   d. Use gauze to move the tongue to each side.

19. A nurse performs an assessment on a patient complaining of a sore throat. Upon assessment, the throat is red, and the tonsils are touching the uvula midline. Using the grading scale of 0 to 4+, how should the nurse document the tonsils?
   a. grade 1+
   b. grade 2+
   c. grade 3+
   d. grade 4+

20. What assessment finding is indicative of candidiasis?
   a. bleeding gums
   b. persistent bad breath
   c. red patches on the oral mucosa
   d. white patches on the tongue

Check Your Understanding Questions

1. What is facial drooping?

2. Describe potential subjective or objective assessment data that may be collected from a patient being evaluated for migraine headaches.

3. What is nystagmus?
4. What is the average size for an adult pupil?
5. What clinical assessment should be performed to assess balance?
6. What are the names of the three bones in the middle ear?
7. What is the name of the snail-shaped structure responsible for converting sound vibrations into electrical signals that the brain can interpret as sound?
8. What is the difference between cleft lip and cleft palate?
9. What is the term used to describe persistent bad breath, even after brushing one's teeth?
10. How should the nurse assess the uvula? How should a normal uvula present?

Reflection Questions

1. Why might individuals with Bell palsy experience dry eyes?
2. Social determinants of health are factors that influence an individual's health and well-being. What social determinants of health are related to assessment of the mouth, throat, nose, and sinuses?
3. You enter the patient's room to administer their medications scheduled for 8 a.m. Upon entering the room, you notice the patient is eating breakfast. The patient coughs right after swallowing a bite of food and states, "I'm fine, sometimes my food just gets caught in my throat." How should you proceed?

What Should the Nurse Do?

The nurse is caring for a 12-year-old patient who complains of ear pain to the right ear for four days. Pain rated 7/10 on the numerical scale. Temperature is 99.9°F (37.7°C), pulse is 87, blood pressure is 115/64, oxygen saturation is 100 percent on room air.

Scenario update: The external auditory canal is clear and not reddened. The tympanic membrane is bulging and red. The patient reports having had reoccurring ear infections since childhood.

1. Which symptoms are concerning (identifying cues)?
2. What additional information is needed (analyzing cues)?
3. What do you think is going on with the patient (prioritizing hypothesis)?

A patient presents to the doctor complaining of a sore throat for the past three days. Upon physical assessment, the nurse notes the patient's throat is red, tonsils measure grade 3+, and voice is hoarse. Pertinent past medical history includes strep throat, tonsillectomy, and seasonal allergies.

4. What assessment data provide conflicting information?
5. What should the nurse do prior to documenting the findings?
6. What additional assessment data are needed?

Competency-Based Assessments

1. Role-play completing an assessment of the head and neck.
2. Demonstrate the procedure for assessing a patient's peripheral vision.
3. Create a video demonstrating how to perform Weber and Rinne tests.
4. Draw a concept map to demonstrate the hearing process.
5. Review the competency checklists for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 23

Assessment of the Thorax, Lungs, Breast, and Lymphatic System

FIGURE 23.1 A thorough evaluation of the lungs and thorax is an essential element when completing a comprehensive physical assessment. (credit: modification of work "Naval Branch Health Clinic Albany Occupational Health" by Deidre Smith/Naval Hospital Jacksonville/Flickr, Public Domain)

CHAPTER OUTLINE

23.1 Structure and Function
23.2 Physical Assessment of the Thorax
23.3 Breath Sounds and Lung Assessment
23.4 Breast and Lymphatic System

INTRODUCTION Assessment of the respiratory and lymphatic systems includes collecting subjective and objective data through a detailed interview and physical examination of the thorax, lungs, breasts, and lymph nodes. This examination can offer significant clues related to issues associated with the body's ability to obtain adequate oxygen to perform daily functions and the immune system's ability to respond to infection. Inadequacy in respiratory or lymphatic function can have significant implications for the overall health of the patient.

23.1 Structure and Function

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the structures of the thorax
- Recognize the mechanism of breathing
- Describe the differences in lung volumes or capacities

The major organs of the respiratory system function primarily to provide oxygen to body tissues for cellular respiration, remove carbon dioxide as a waste product, and help maintain acid-base balance (Figure 23.2). Portions of the respiratory system are also used for nonvital functions, such as sensing odors, speech production, and for straining, such as during childbirth or coughing.

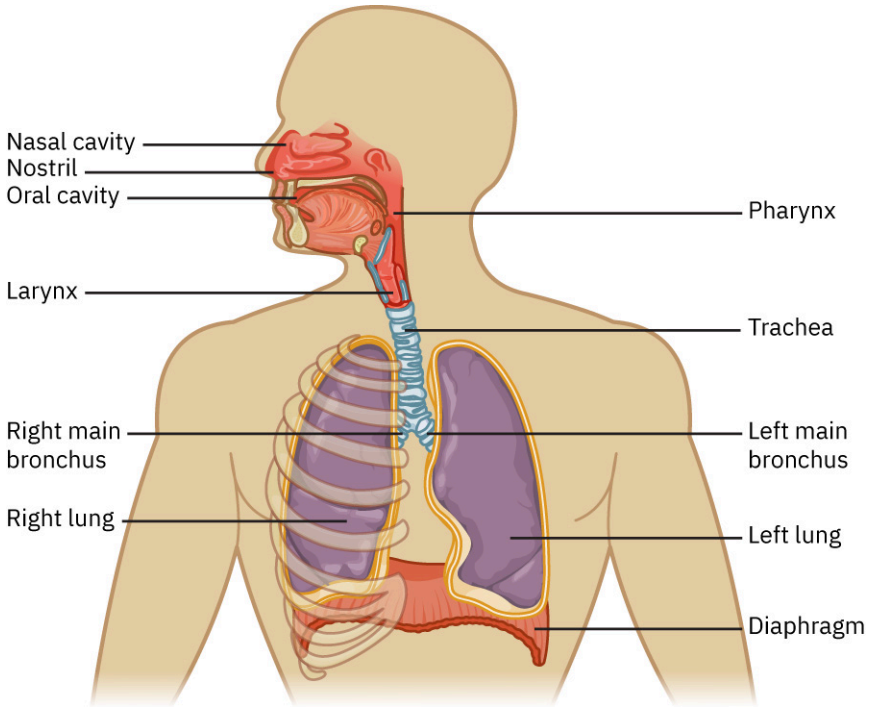


FIGURE 23.2 Major organs of the respiratory system include the trachea, bronchi, lungs, and diaphragm. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Structures of the Thorax

The **thorax**, commonly known as the chest, begins at the neck and extends to the top of the abdomen. The two major parts of the thorax include the thoracic cage and the thoracic cavity.

Thoracic Cage

The **thoracic cage**, also called the rib cage, forms the thorax (chest) portion of the body (Figure 23.3). It consists of the twelve pairs of ribs with their costal cartilages and the sternum. The ribs are anchored posteriorly to the twelve thoracic vertebrae (T1–T12). The main function of the thoracic cage is to protect the heart and lungs from injury.

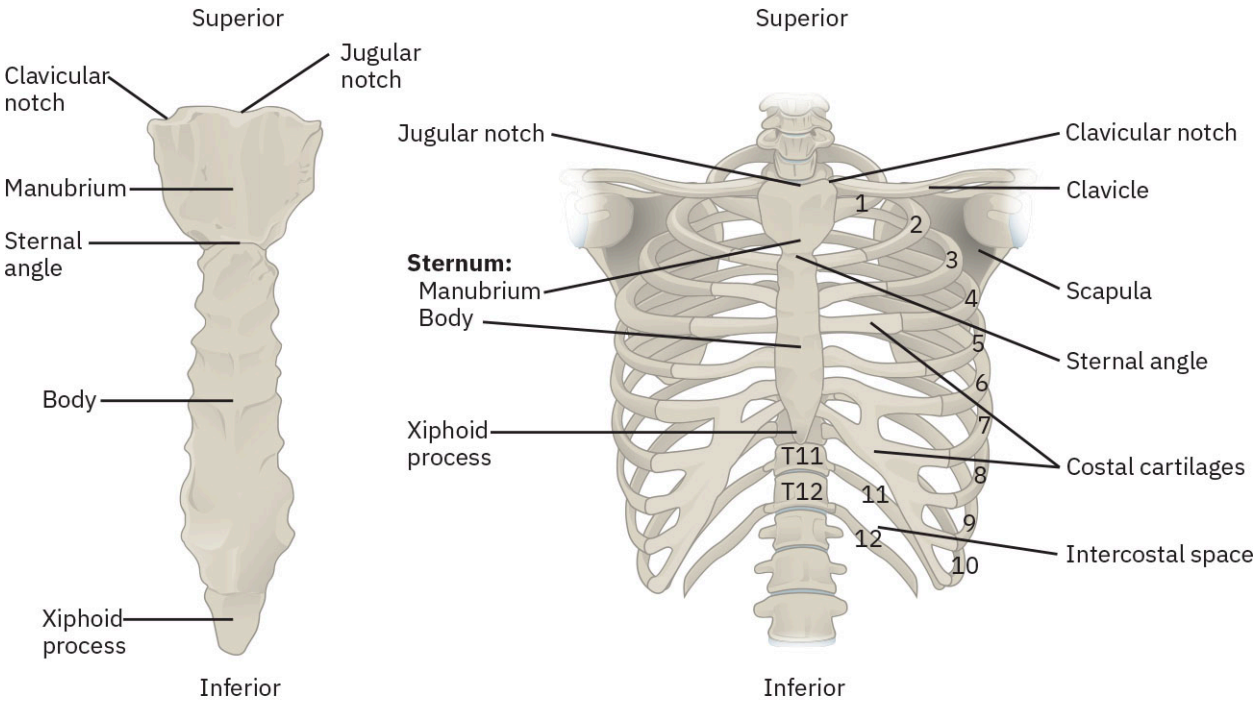


FIGURE 23.3 The thoracic cage is formed by the (a) sternum and (b) twelve pairs of ribs with their costal cartilages. The ribs are classified as true ribs (1–7) and false ribs (8–12). The last two pairs of false ribs are also known as floating ribs (11–12). (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Sternum and Clavicles

The **sternum** is the elongated bony structure that anchors the anterior thoracic cage. It consists of three parts: the manubrium, the body, and the xiphoid process (Figure 23.3). The **manubrium** is the wider, superior portion of the sternum. The top of the manubrium has a shallow, U-shaped border called the **jugular (suprasternal) notch**. This can be easily felt at the anterior base of the neck, between the medial ends of the clavicles. The **clavicular notch** is the shallow depression located on either side at the superior-lateral margins of the manubrium. This is the site of the **sternoclavicular joint**, between the sternum and clavicle. The first ribs also attach to the manubrium.

The elongated, central portion of the sternum is the body. The manubrium and body join at the sternal angle, so named because the junction between these two components forms a slight bend. The second rib attaches to the sternum at the sternal angle. Because the first rib is hidden behind the clavicle, the second rib is the highest rib that can be identified by palpation. Thus, the sternal angle and second rib are important landmarks for the identification and counting of the lower ribs. Ribs 3 to 7 are attached to the sternal body. The inferior tip of the sternum is the **xiphoid process**. This small structure is cartilaginous early in life, but gradually becomes ossified (turns into bone) starting during middle age.

Ribs and Thoracic Vertebrae

Each rib is a curved, flattened bone that contributes to the wall of the thorax. The ribs articulate posteriorly with the T1 to T12 thoracic vertebrae, and most attach anteriorly via their costal cartilages to the sternum. There are twelve pairs of ribs that are numbered 1 to 12 in accordance with the thoracic vertebrae. Thoracic vertebrae have articulation sites, called facets, where the rib is attached. Most thoracic vertebrae have two facets located on the lateral sides of the body, each of which is called a costal facet (*costal* means “rib”). These are for articulation with the head (end) of a rib. An additional facet is located on the transverse process for articulation with the tubercle of a rib.

Reference Lines

Imaginary “reference” lines can be visualized on the thorax to assist with performing the physical examination and determining the anatomical layout of the chest. The three reference lines are the midclavicular line, the anterior axillary line, and the midaxillary line (Figure 23.4). The midclavicular line is used most often and runs from the middle of the clavicle down the chest. This line can be used to help find the apex of the heart and various intercostal

spaces during the physical assessment.

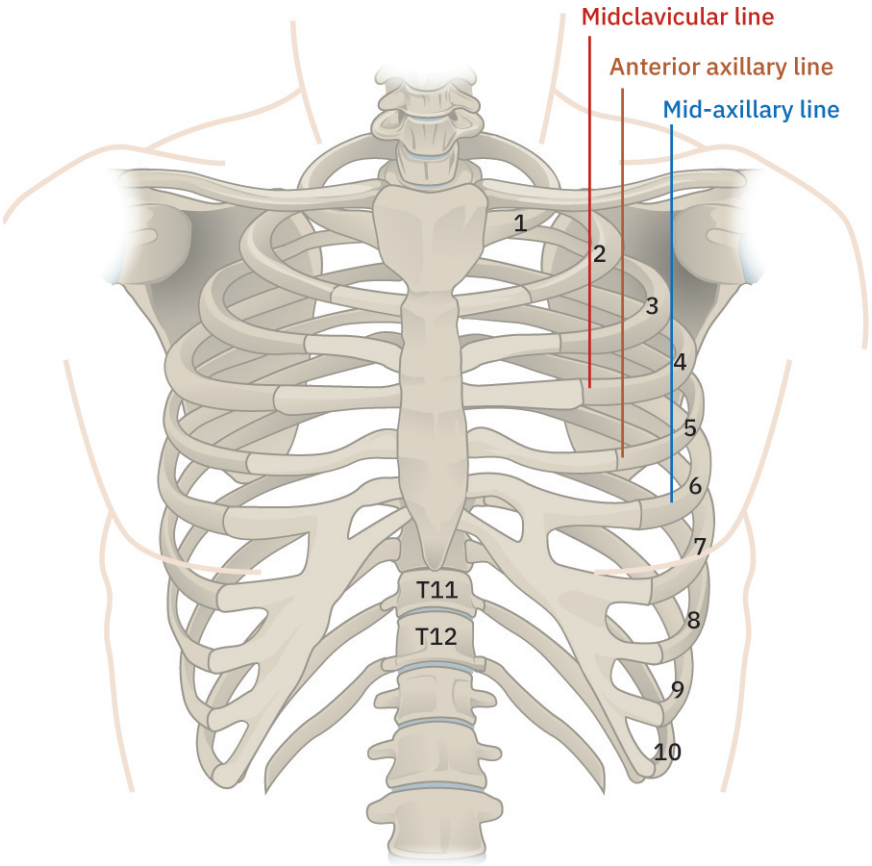


FIGURE 23.4 Reference lines can be used to locate anatomical structures in the thoracic cage, apply telemetry leads in the correct places, and perform procedures in the appropriate anatomical area. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Thoracic Cavity

The thoracic cavity is the large compartment in the chest that contains many vital organs and tissues including the heart and lungs (Figure 23.5). The organs and tissues in the thoracic cavity are protected from injury by the bony structures (ribs and sternum) of the thoracic cage.

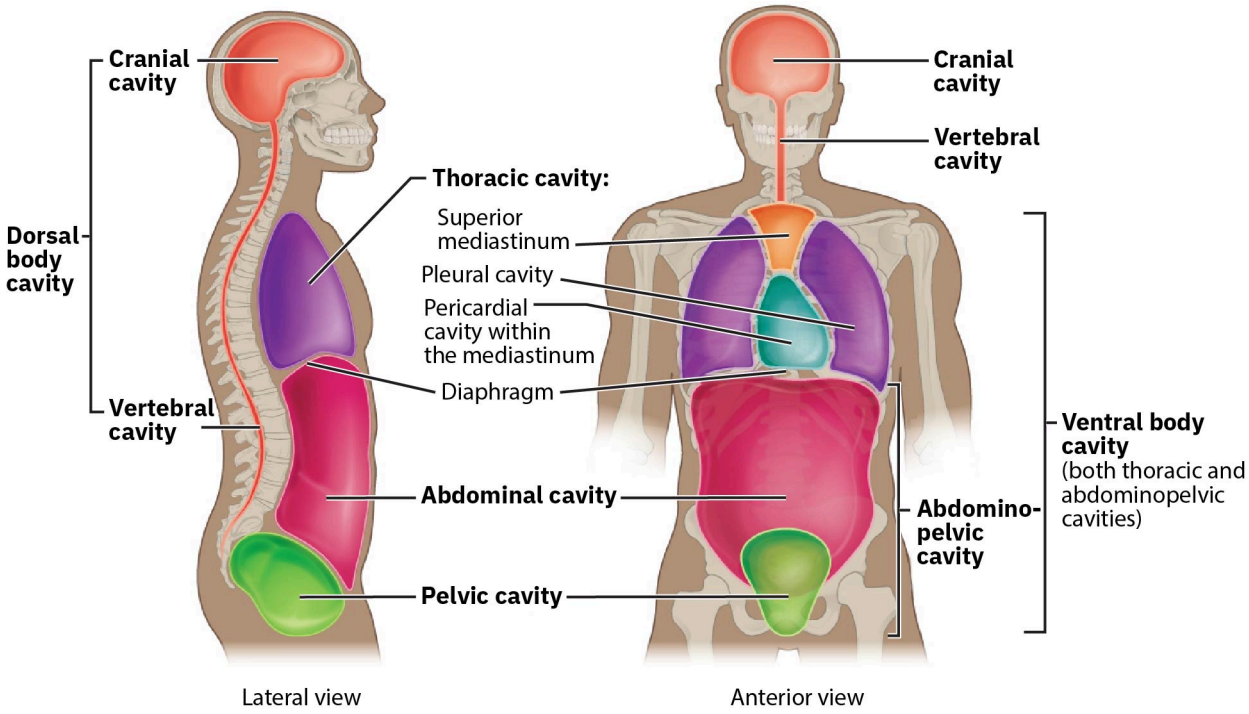


FIGURE 23.5 The thoracic cavity consists of the pleural cavity, which contains the lungs, and the pericardial cavity, which contains the heart. (credit: "Dorsal Ventral Body Cavities.jpg" by Connexions/Wikimedia Commons, CC BY 3.0)

Larynx and Trachea

The larynx is a cartilaginous structure that connects the pharynx (part of throat) to the trachea and helps regulate the volume of air that enters and leaves the lungs (Figure 23.6). Three large cartilage pieces—the thyroid cartilage (anterior), epiglottis (superior), and cricoid cartilage (inferior)—form the major structure of the larynx. The thyroid cartilage is the largest piece of cartilage that makes up the larynx. The thyroid cartilage consists of the laryngeal prominence, or "Adam's apple," which tends to be more prominent in males. The thick cricoid cartilage forms a ring, with a wide posterior region and a thinner anterior region. Three smaller, paired cartilages—the arytenoids, corniculates, and cuneiforms—attach to the epiglottis and the vocal cords and muscle that help move the vocal cords to produce speech.

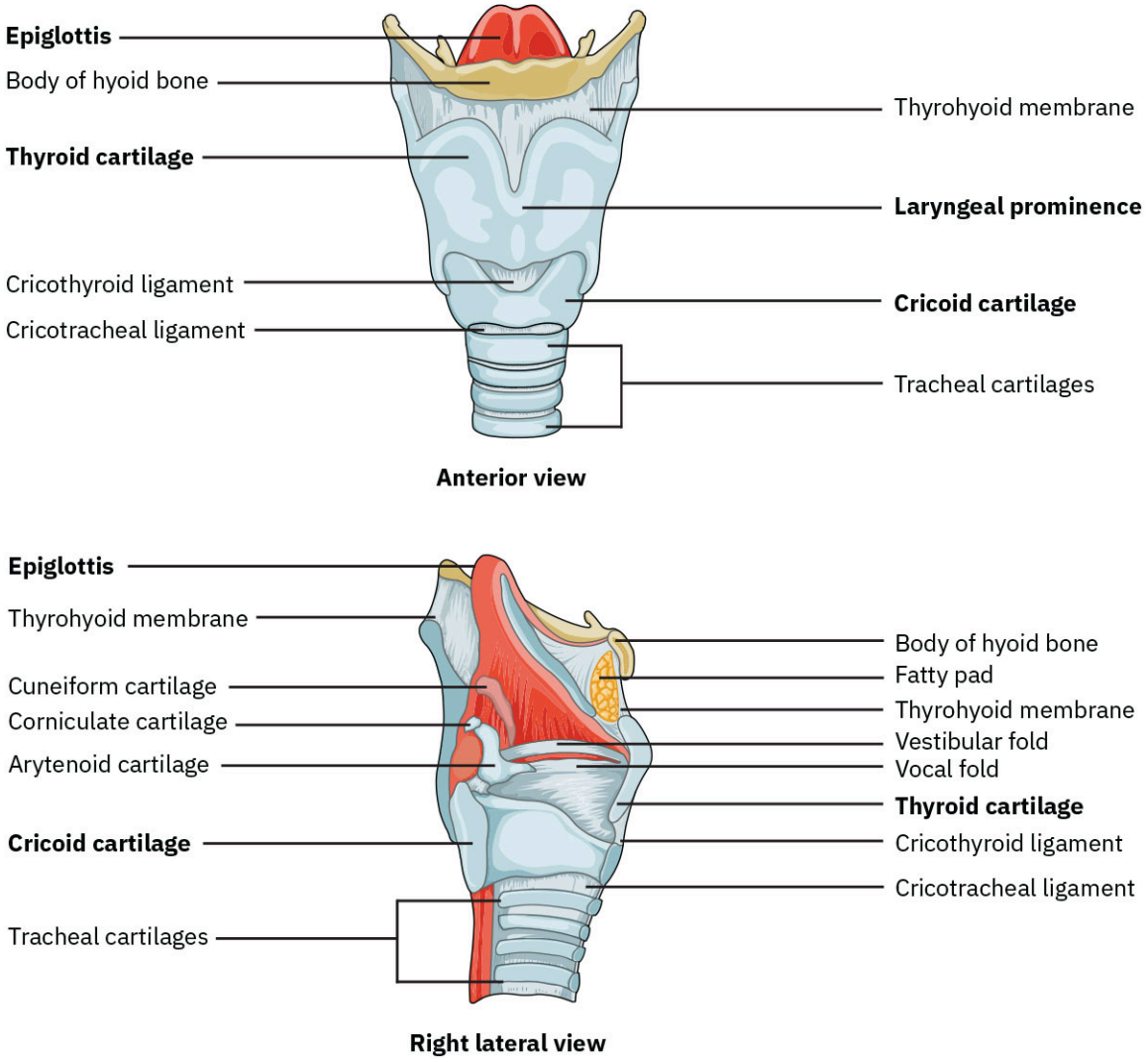


FIGURE 23.6 The larynx extends from the laryngopharynx and the hyoid bone to the trachea. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

The **trachea** (windpipe) extends from the larynx toward the lungs. The trachea is formed by sixteen to twenty stacked, C-shaped pieces of hyaline cartilage that are connected by dense connective tissue. The trachealis muscle and elastic connective tissue together form the **fibroelastic membrane**, a flexible membrane that closes the posterior surface of the trachea, connecting the C-shaped cartilages. The fibroelastic membrane allows the trachea to stretch and expand slightly during inhalation and exhalation, whereas the rings of cartilage provide structural support and prevent the trachea from collapsing. In addition, the trachealis muscle can be contracted to force air through the trachea during exhalation.

Bronchi and Bronchioles

The trachea branches into the right and left primary bronchi at the carina (Figure 23.7). The carina is a raised structure that contains specialized nervous tissue that induces violent coughing if a foreign body, such as food, is present. Rings of cartilage, like those of the trachea, support the structure of the bronchi and prevent their collapse. The primary bronchi enter the lungs at the **hilum**, a concave region where blood vessels, lymphatic vessels, and nerves also enter the lungs. The main function of the bronchi is to provide a passageway for air to move into and out of each lung. The primary bronchi branch into secondary and tertiary bronchi, which then form bronchioles. Bronchioles, which are about 0.04 in (1 mm) in diameter, further branch until they become the tiny terminal bronchioles and lead to the structures of gas exchange, called alveoli (Figure 23.8).

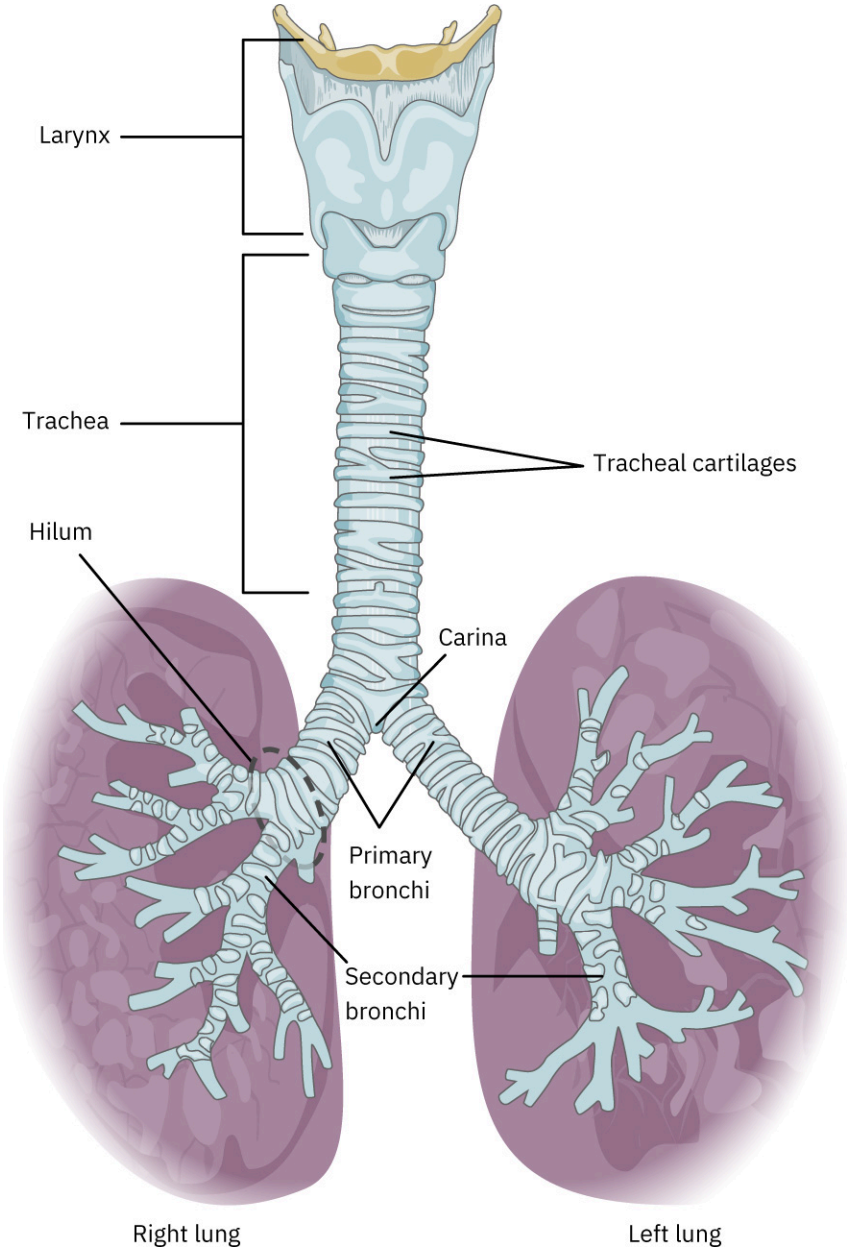


FIGURE 23.7 The tracheal tube splits into primary and secondary bronchi, which extend into each lung. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

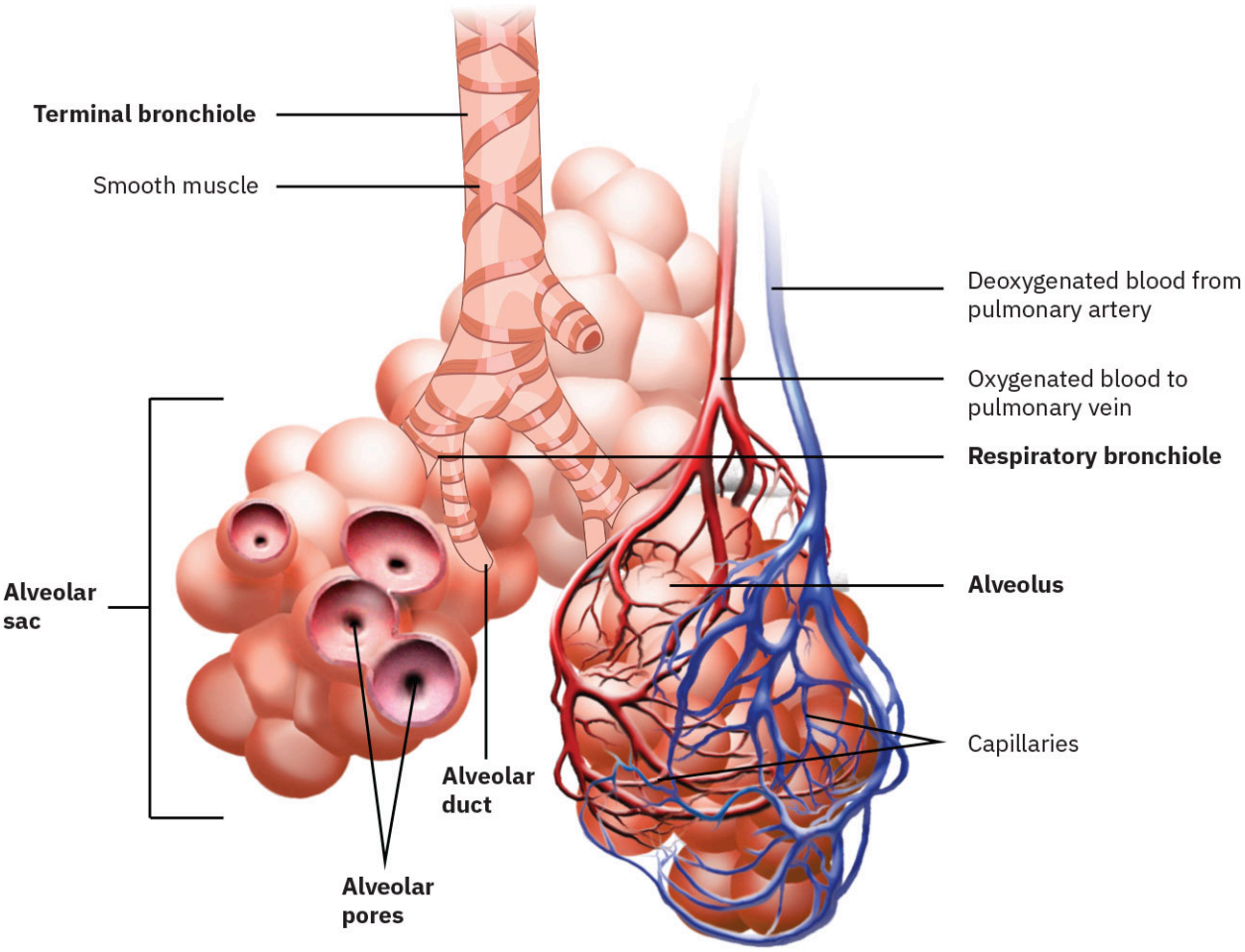


FIGURE 23.8 Bronchioles lead to alveolar sacs in the respiratory zone, where gas exchange occurs. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Lungs and Pleural Membranes

The lungs are pyramid-shaped, paired organs that are connected to the trachea by the right and left bronchi and bordered inferiorly by the diaphragm. The right lung is shorter and wider than the left lung, and the left lung occupies a smaller volume than the right. The cardiac notch is an indentation on the surface of the left lung, and it allows space for the heart (Figure 23.9). The apex of the lung is the superior region, whereas the base is the opposite region near the diaphragm. Each lung is composed of smaller units called lobes. The right lung consists of three lobes: the superior, middle, and inferior lobes. The left lung consists of two lobes: the superior and inferior lobes. Each segment of the lung receives air from its own tertiary bronchus and is supplied with blood by its own artery.

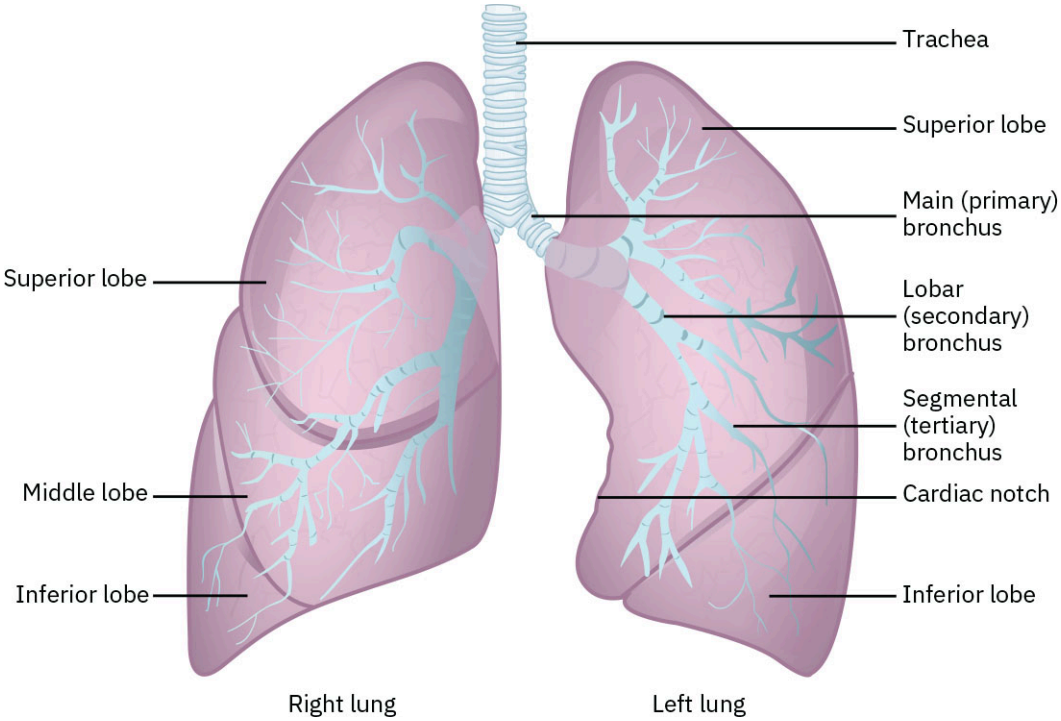


FIGURE 23.9 Gross anatomy of the lungs is shown. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Each lung is enclosed within a cavity that is surrounded by the **pleura**, a double-layered serous membrane that surrounds the lung. The right and left pleurae, which enclose the right and left lungs, respectively, consist of two layers. The **visceral pleura** is the innermost layer, which lies superficial to the lungs (Figure 23.10). In contrast, the **parietal pleura** is the outer layer that connects to the thoracic wall, mediastinum, and diaphragm. The **pleural cavity** is the space located between the visceral and parietal layers. The pleural cavity contains a small amount of pleural fluid that is used as lubrication to reduce friction between the layers to prevent trauma during breathing and create surface tension that helps maintain the position of the lungs against the thoracic wall.

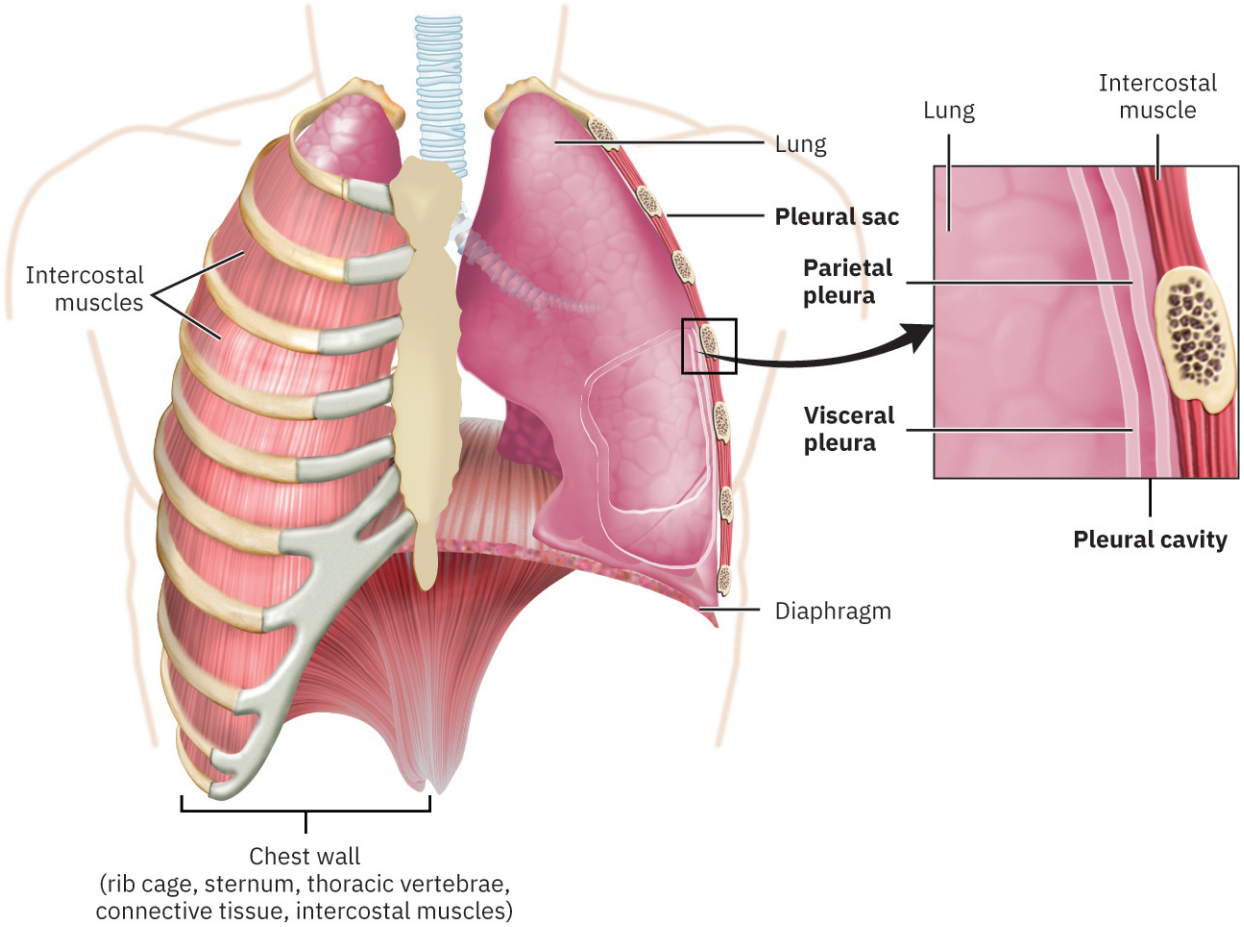


FIGURE 23.10 Parietal and visceral pleural membranes of the lungs form the pleural cavity. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Mechanism of Breathing

Breathing usually occurs without thought, although at times you can consciously control it, such as when you swim under water, sing a song, or blow bubbles. The respiratory rate is the total number of breaths, or respiratory cycles, that occur each minute. Respiratory rate can be an important indicator of disease, as the rate may increase or decrease during an illness or with certain medical conditions. The respiratory rate is controlled by the respiratory center located in the brain, which responds to changes in carbon dioxide, oxygen, and pH levels in the blood.

Pressure Relationships

The intra-alveolar and intrapleural pressures are dependent on certain physical features of the lung. However, the ability to breathe—to have air enter the lungs during **inspiration** and air leave the lungs during **expiration**—is dependent on the air pressure of the atmosphere and the air pressure within the lungs. Pulmonary ventilation (breathing) is dependent on three types of pressure: atmospheric, intra-alveolar, and intrapleural (Table 23.1).

Type of Pressure	Description
Atmospheric pressure	• Amount of force that is exerted by gases in the air surrounding any given surface (such as the body) • Expressed in terms of the unit atmosphere (atm) or in millimeters of mercury (mm Hg); one atm is equal to 760 mm Hg (the atmospheric pressure at sea level) • Other respiratory pressure values are typically discussed in relation to atmospheric pressure
Intra-alveolar (intrapulmonary) pressure	• Pressure of air within the alveoli, which changes during different phases of breathing • Because alveoli are connected to the atmosphere via airway tubing, intrapulmonary pressure of alveoli always equalizes with atmospheric pressure
Intrapleural pressure	Pressure of air within the pleural cavity (between visceral and parietal pleurae) • Always lower than, or negative to, intra-alveolar pressure (and therefore also to atmospheric pressure) • Although it fluctuates during inspiration and expiration, intrapleural pressure remains approximately −4 mm Hg throughout breathing cycle

TABLE 23.1 Types of Pressure Involved in Breathing Mechanics

The difference in pressures drives pulmonary ventilation because air flows down a pressure gradient; that is, air flows from an area of higher pressure to an area of lower pressure. Air flows into the lungs largely due to a difference in pressure; atmospheric pressure is greater than intra-alveolar pressure, and intra-alveolar pressure is greater than intrapleural pressure. Air flows out of the lungs during expiration based on the same principle; pressure within the lungs becomes greater than the atmospheric pressure. For example, in geographical areas of higher altitude, there is less atmospheric pressure, which affects breathing.

LINK TO LEARNING

View this video for more information about breathing mechanics and gas exchange (https://openstax.org/r/77breathingmec) in the lungs.

Pulmonary Ventilation (Inspiration and Expiration)

Pulmonary ventilation is comprised of two major steps: inspiration and expiration. Inspiration is the process that causes air to enter the lungs, and expiration is the process that causes air to leave the lungs (Figure 23.11). A respiratory cycle is one sequence of inspiration and expiration. In general, two muscle groups are used during normal inspiration: the diaphragm and the external intercostal muscles. Additional muscles can be used if a bigger breath is required. When the diaphragm contracts, it moves inferiorly toward the abdominal cavity, creating a larger thoracic cavity and more space for the lungs. Contraction of the external intercostal muscles moves the ribs upward and outward, causing the rib cage to expand, which increases the volume of the thoracic cavity. Due to the adhesive force of the pleural fluid, the expansion of the thoracic cavity forces the lungs to stretch and expand as well. This increase in volume leads to a decrease in intra-alveolar pressure, creating a pressure lower than atmospheric pressure. As a result, a pressure gradient is created that drives air into the lungs.

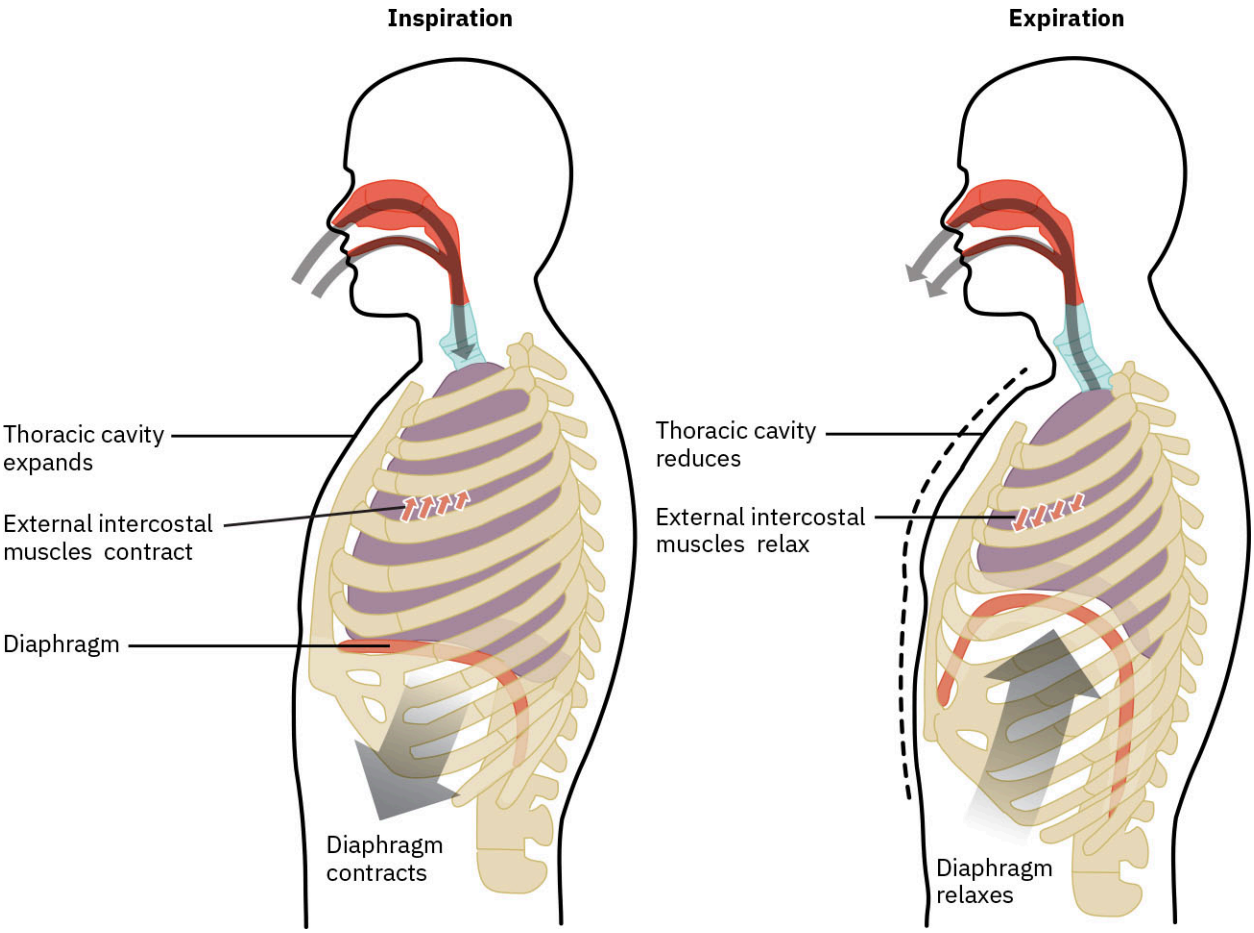


FIGURE 23.11 Inspiration and expiration occur due to the expansion and contraction of the thoracic cavity, respectively. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Oxygen Transport

All organs and tissues require oxygen for optimal functioning, so it is vital that oxygen-transport mechanisms work properly to maintain an adequate supply for the body. Deoxygenated, or venous, blood is brought to the right side of the heart from the veins. Once in the heart, the blood is sent to the lungs via the pulmonary artery so that gas exchange may occur within the alveoli. During gas exchange, oxygen is added to the blood and carbon dioxide is removed from the blood as a waste product (Figure 23.12). Oxygen is then transported by the blood to organs and tissues in two different forms: bound to hemoglobin in red blood cells or directly dissolved in plasma.

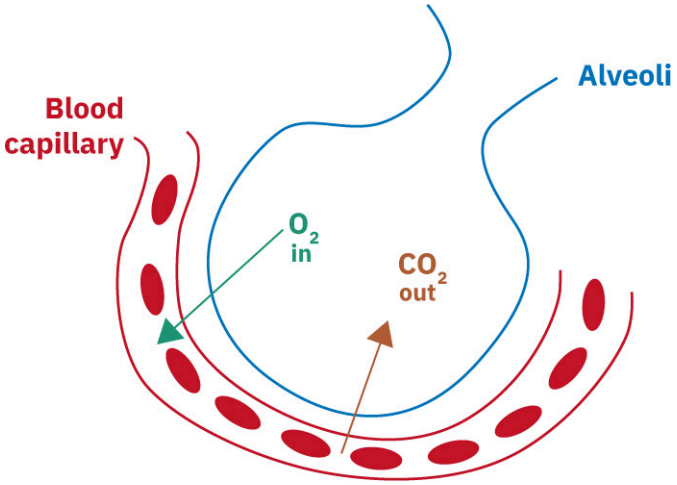


FIGURE 23.12 Oxygen is added to the blood and carbon dioxide is removed from the blood during gas exchange in the alveoli of the lungs. (credit: modification of "Gas exchange in the aveolus simple (en).svg" by domdomegg/Wikimedia Commons, CC BY 4.0)

Respiratory Volumes and Capacities

The term used for various volumes of air moved by or associated with the lungs at a given point in the respiratory cycle is called **respiratory volume**. There are four major types of respiratory volumes: tidal, residual, inspiratory reserve, and expiratory reserve (Table 23.2). Respiratory volumes are dependent on a variety of factors, and measuring the different types can provide important clues about a patient's respiratory health.

Type of Respiratory Volume	Description
Tidal volume (TV)	• Amount of air that normally enters the lungs during quiet breathing (about 500 mL)
Expiratory reserve volume (ERV)	• Amount of air that can be forcefully exhaled past a normal tidal expiration
Inspiratory reserve volume (IRV)	• Extra volume of air that can be brought into the lungs during a forced inspiration
Residual volume (RV)	• Air left in the lungs after exhaling as much air as possible • Prevents alveoli from collapsing

TABLE 23.2 Types of Measurable Respiratory Volumes

The combination of two or more selected respiratory volumes is called **respiratory capacity**, which further describes the amount of air in the lungs during a given time. For example, **total lung capacity (TLC)** is the sum of all the lung volumes (TV, ERV, IRV, and RV), which represents the total amount of air a person can hold in the lungs after a forceful inhalation. The other types of respiratory capacities are described in Table 23.3.

Type of Respiratory Capacity	Description
Vital capacity (VC)	• Total amount of air a person can move in or out of lungs • Sum of all the volumes except RV • VC = TV + ERV + IRV
Inspiratory capacity (IC)	• Maximum amount of air that can be inhaled past a normal tidal expiration • Sum of TV and IRV • IC = TV + IRV
Functional residual capacity (FRC)	• Amount of air that remains in the lung after a normal tidal expiration • Sum of ERV and RV • FRC = ERV + RV

TABLE 23.3 Types of Measurable Respiratory Capacities

23.2 Physical Assessment of the Thorax

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Analyze how to collect subjective data for assessment of the thorax
- Describe how to collect objective data for assessment of the thorax
- Recall abnormalities found in the thorax assessment

With an understanding of the basic structures and primary functions of the thorax, the nurse collects subjective and objective data to perform a focused chest assessment. Because the thorax contains vital organs including the lungs and heart, it is imperative that the nurse complete a thorough examination and note any abnormalities. Abnormal findings of the thorax may indicate more severe health problems and may affect the body's ability to transport adequate amounts of oxygen and blood to organs and tissues.

Nursing Assessment: Collecting Subjective Data

The nurse can collect subjective data during the focused thorax assessment by using interview questions, paying particular attention to what the patient is reporting. The interview should include questions regarding any history of or current respiratory health conditions or illnesses, medication use, and any self-reported symptoms. The nurse should consider the patient's age, gender, family history, race, culture, environmental factors, and current health practices when gathering subjective data.

Obtaining Health History

The information discovered during the interview process guides the physical exam and subsequent patient education. See Table 23.4 for sample interview questions to use during a focused respiratory and thorax assessment.

Interview Questions	Follow-Up
Have you ever been diagnosed with a respiratory condition, such as asthma, COPD, pneumonia, or allergies? Do you use oxygen or peak flow meter? Do you use home respiratory equipment such as CPAP, BiPAP, or nebulizer devices?	• Please describe the conditions and treatments.
Are you currently taking any medications, herbs, or supplements for respiratory concerns?	• Please identify what you are taking and the purpose of each.

TABLE 23.4 Interview Questions for Subjective Assessment of the Respiratory System and Thorax

Interview Questions	Follow-Up
Have you had any feelings of breathlessness (dyspnea)?	Note: If the shortness of breath is severe or associated with chest pain, discontinue the interview and obtain emergency assistance. • Are you having any shortness of breath now? If yes, please rate your symptoms from zero to ten, with "0" being none and "10" being severe. • Does anything bring on the shortness of breath (e.g., activity, animals, food, or dust)? If activity causes the shortness of breath, how much exertion causes symptoms? • When did the shortness of breath start? • Is the shortness of breath associated with chest pain or discomfort? • How long does the shortness of breath last? • What makes the shortness of breath go away? • Is the shortness of breath related to a position, such as lying down? • Do you wake up at night feeling short of breath? How many pillows do you sleep on? • How does the shortness of breath affect your daily activities?
Do you have a cough?	• When you cough, do you bring up anything? What color is the phlegm? • Do you cough up any blood (hemoptysis)? • Do you have any associated symptoms with the cough such as fever, chills, or night sweats? • How long have you had the cough? • Does anything bring on the cough (such as activity, dust, animals, or change in position)? • What have you used to treat the cough? Has it been effective?

TABLE 23.4 Interview Questions for Subjective Assessment of the Respiratory System and Thorax

Identifying Lifestyle and Health Practices

Chronic respiratory disorders are common, accounting for nearly 7.5 million deaths per year (Glass & Rosenthal, 2018). Though these disorders are not always completely preventable, there are certain modifiable lifestyle factors associated with their development. While obtaining the health history, the nurse should assess for the following factors that may contribute to respiratory disorders:

- tobacco use and/or vaping
- environmental pollution within the home or from occupational exposures
- refusing vaccines (e.g., influenza or COVID-19)
- physical inactivity
- having a higher weight
- poor dietary habits (e.g., limited intake of fruit and vegetables)

PATIENT CONVERSATIONS

What If Your Patient Reports Tobacco Use or Vaping?

Scenario: Nurse walks into the patient's room to obtain a health history. The patient has recently been diagnosed

with chronic obstructive pulmonary disease (COPD).

Nurse: Hi, my name is Julie, and I'll be your nurse today. Can you confirm your name and date of birth before we get started?

Patient: Sure. It's Jeremy Reed and my birthday is 12/16/1970.

Nurse. Great, thank you. So I see here that you were recently diagnosed with COPD, does that sound right?

Patient: Yeah, it does. My doctor said my lungs are shot from all the smoking and vaping I do. I've cut back some over the years but I do still smoke occasionally.

Nurse: I see. It's great that you've cut back. How many years have you been smoking in total?

Patient: I started pretty young so I would say around thirty-five years or so but I only smoke about a pack per week now. I used to smoke a pack a day.

Nurse: That's definitely an improvement, but have you ever tried quitting smoking completely?

Patient: I tried stopping cold turkey one time but it was terrible. I was super jittery and had to start again like a week later.

Nurse: It's great that you tried quitting and I would strongly advise that you try quitting again. Smoking is a huge risk factor for respiratory diseases, especially COPD. Continuing to smoke will make your COPD more severe.

Patient: Yeah, I hear you. But it's so hard to stay motivated to quit. It's just easier to keep doing things the way I've always done them.

Nurse: I understand. If you're willing to try, I would love to connect you with some resources to help you quit for good. We have access to counselors and support groups here that I think would be really helpful for you.

Patient: Yeah, that actually sounds great. I would really appreciate it!

If the patient is ready to quit, the five successful interventions are the Five As: Ask, Advise, Assess, Assist, and Arrange.

- Ask: Identify and document smoking status for every patient at every visit.
- Advise: In a clear, strong, and personalized manner, urge every user to quit.
- Assess: Is the user willing to make a quitting attempt at this time?
- Assist: For the patient willing to make a quitting attempt, use counseling and pharmacotherapy to help them quit.
- Arrange: Schedule follow-up contact, in person or by telephone, preferably within the first week after the quit date.

Nursing Assessment: Collecting Objective Data

A focused thorax and respiratory objective assessment includes interpretation of vital signs; inspection of the patient's breathing pattern, skin color, and respiratory status; palpation to identify abnormalities; and auscultation of lung sounds using a stethoscope. The nurse must understand what is expected for the patient's age, gender, development, race, culture, environmental factors, and current health condition to determine the meaning of the data that are being collected.

Inspecting the Thorax

Inspection of the thorax during a focused respiratory assessment includes observation of chest configuration and symmetry in addition to the patient's breathing rate, pattern, and effort (Figure 23.13). First, the nurse will perform a visual inspection to observe the patient's chest for symmetry and overall configuration. The trachea should be midline and the clavicles should be symmetrical to each other. Note the location of the ribs, sternum, clavicle, and scapula, as well as the underlying lobes of the lungs. When the patient breathes, chest movement should be symmetrical during both inspiration and expiration. While inspecting the chest, observe the anterior-posterior diameter and compare it to the transverse diameter. The nurse must assess the shape and size for comparison. The expected anteroposterior-transverse ratio should be 1:2.

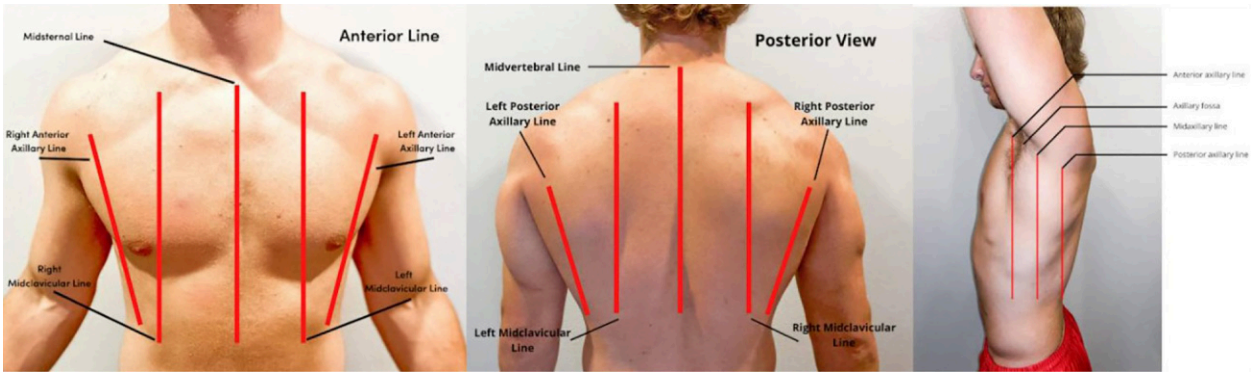


FIGURE 23.13 Landmarks of the anterior, posterior, and lateral thorax are shown. (credit: "Anterior_Chest_Lines.png," "Posterior_Chest_Lines.png," and "Lateral_Chest_Lines.png" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

After inspecting the chest for configuration and symmetry, the patient's breathing pattern should be observed, including obtaining the respiratory rate over a full minute. The normal range for the respiratory rate of an adult is twelve to twenty breaths per minute. Breathing effort should be nonlabored and in a regular rhythm. Observe the depth of respiration and note if the respiration is shallow or deep. Inspiration should last half as long as expiration unless the patient is active, in which case the ratio increases to 1:1.

Palpating the Thorax

Palpation of the chest may be performed to investigate for areas of abnormality related to injury or procedural complications. For example, if a patient has a chest tube or has recently had one removed, the nurse may palpate near the tube insertion site to assess for areas of air leak or **crepitus**. Crepitus feels like a popping or crackling sensation when the skin is palpated and is a sign of air trapped under the subcutaneous tissues. If palpating the chest, use light pressure with the fingertips to examine the anterior and posterior chest wall. Chest palpation may be performed to assess specifically for growths, masses, crepitus, pain, or tenderness. Confirm symmetric chest expansion by placing your hands on the anterior or posterior chest at the same level, with thumbs over the sternum anteriorly or the spine posteriorly. As the patient inhales, your thumbs should move apart symmetrically.

LIFE-STAGE CONTEXT

Respiratory Changes in Older Adults

The function of the lungs tends to decrease with age. Beginning around age thirty-five, lung capacity decreases due to physiological changes including the alveoli losing their shape, diaphragm weakness, thinning ribs, and immune system vulnerability. Though these changes are unavoidable with aging, certain lifestyle changes such as smoking cessation, avoiding air pollution, exercising, and maintaining a healthy body weight may slow the progression.

Abnormalities in Thorax Assessment

Abnormalities in the thorax and respiratory assessment may indicate underlying conditions that can become life-threatening if not treated effectively (Table 23.5). Pursed-lip breathing, nasal flaring, audible breathing, intercostal **retraction** (the "pulling in" of muscles between the ribs or in the neck when breathing), anxiety, and the use of accessory muscles are signs of respiratory difficulty and should be evaluated quickly to prevent complications or respiratory arrest.

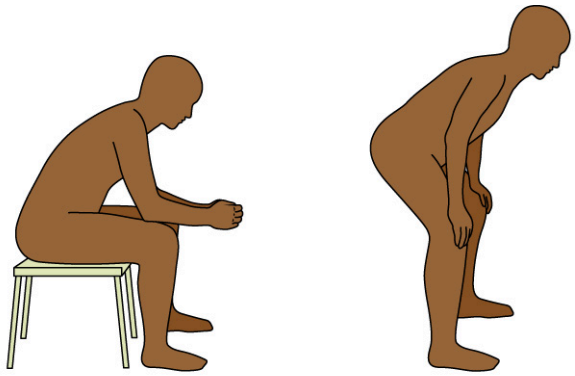
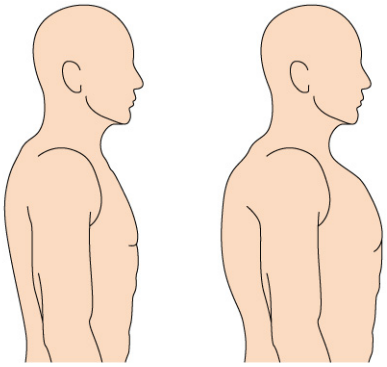
Abnormal Finding	Description
Prolonged expiration	• Results from conditions causing difficulty expelling air, such as with emphysema
"Tripod" positioning	• Patients who are experiencing significant breathing difficulty may find relief while in a "tripod" position, which helps the lungs expand, improving respiratory status  **(a)** Sitting tripod position **(b)** Standing tripod position (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)
Barrel chest	• Anteroposterior-transverse chest ratio is 1:1 as opposed to the normal ratio of 1:2 • Often seen in patients with COPD due to chronic hyperinflation of the lungs  **(a)** Normal chest **(b)** Barrel chest (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

TABLE 23.5 Abnormal Findings of the Thorax Assessment

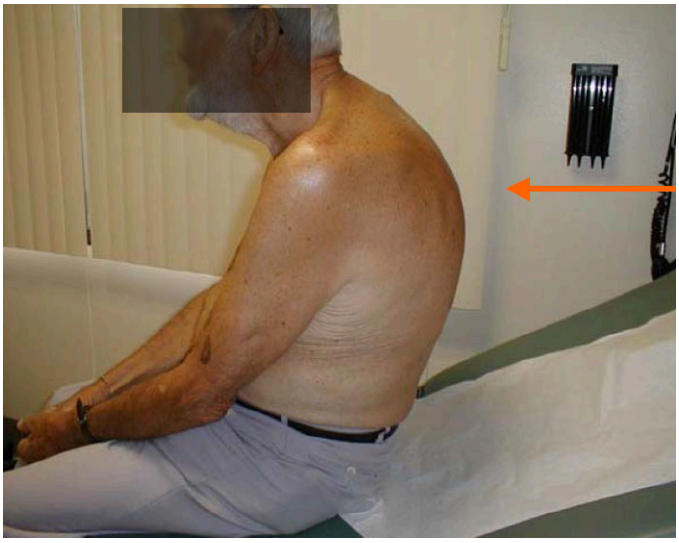
Abnormal Finding	Description
Kyphosis	• Outward curvature of the spine often seen in older adults  (credit: “Posturalkyphosis.png” by "CarpalTunnelEx"/Wikimedia Commons, Public Domain)
Unequal chest expansion	• If the chest expands more on one side than the other, it may indicate an underlying condition such as pneumonia or thoracic trauma (e.g., fractured ribs, pneumothorax)

TABLE 23.5 Abnormal Findings of the Thorax Assessment

REAL RN STORIES

Assessing Respiratory Distress

Nurse: Jenna, BSN
Clinical setting: Emergency department
Years in practice: 1
Facility location: Inner city of a large metropolitan area in Missouri

I was a new nurse in a very busy emergency department. Between another wave of COVID-19, the flu, and car accidents due to the icy road conditions, we had maintained maximum capacity in the entire hospital for the last several weeks.

After performing a quick assessment on all seven of my patients at the beginning of my shift, I got a call from the charge nurse letting me know that I would be receiving a patient from a local nursing home who was reporting some shortness of breath. Almost immediately after getting off the phone with the charge nurse, EMS called and gave me a quick rundown about the patient’s situation. “Hi, Jenna, this is Gerry with EMS. We just picked up Ms. Smith from her nursing home where she was found hunched over, in a tripod position, on the side of her bed struggling to catch her breath. She reports getting up and going to the bathroom but when she got back to her bed, she couldn’t breathe effectively so she called the nurse. We put her on two liters of oxygen via nasal cannula and her oxygen saturation improved to 93 percent but she’s pretty anxious and breathing heavily, so we’re bringing her to the hospital just in case. See you shortly.”

Upon arrival, Ms. Smith appeared to be feeling better and her oxygen saturation was 96 percent. I performed a quick assessment, hooked her up to the monitor, and went to check on a few of my unstable patients. About an hour later, Ms. Smith’s oxygen alarm started going off. When I glanced at it, I noticed her oxygen saturation was 90 percent so I

hurried over to her bed to check out the situation. When I got to her bed, the first thing I noticed was that her nostrils were flaring. Upon further assessment, I also noticed that she had put herself into a tripod position and her breathing was extremely rapid and shallow. I increased her oxygen to six liters and used my stethoscope to auscultate her lungs. I heard crackles and limited air movement. She was clearly struggling to breathe. At this point, I called a rapid response. Almost immediately, my charge nurse and several others came running. We got her stabilized and sent her for a chest x-ray. She was found to have a severe case of pneumonia. This story always reminds me of how we must pay attention to the details, even the little ones, because sometimes patients present stable and can quickly progress to a more unstable serious condition.

23.3 Breath Sounds and Lung Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Recognize how to assess the different types of breath sounds
- Identify different respiration patterns
- Examine how to perform a nursing assessment of the lungs

Auscultation of the lungs is one of the most important aspects of a focused respiratory assessment. With practice, you will become proficient at determining whether the sounds you are hearing are normal or if they are indicative of an underlying medical condition. There are several distinct **adventitious**, or abnormal, lung sounds with which you will become familiar.

Auscultation of the Lungs

Correct placement of the stethoscope during auscultation of lung sounds is important to obtain a quality assessment (Figure 23.14). The stethoscope should not be placed over clothes or hair because these may create inaccurate sounds from friction. The best position to listen to lung sounds is with the patient sitting upright; however, if the patient is acutely ill or unable to sit upright, you can turn them side to side in a lying position. Avoid listening over bones, such as the scapulae or clavicles or over the female breasts to ensure you are hearing adequate sound transmission. Listen to sounds from side to side rather than down one side and then down the other side. This side-to-side pattern allows you to compare sounds in symmetrical lung fields.

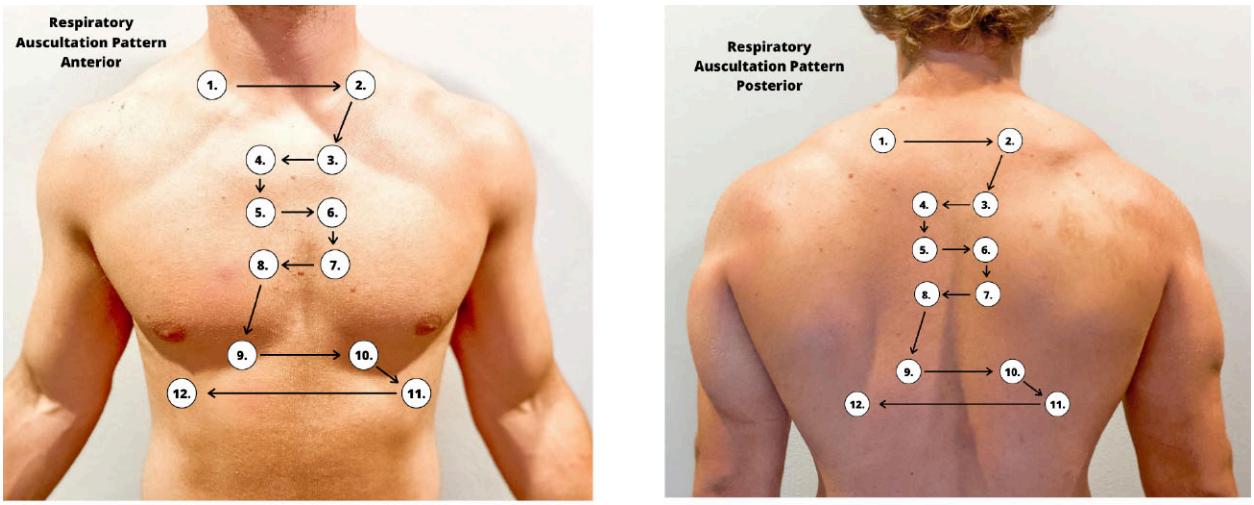


FIGURE 23.14 (a) Anterior and (b) posterior chest wall auscultation areas are shown. (credit: "Anterior Respiratory Auscultation Pattern,png" and "Posterior Respiratory Auscultation Pattern.png" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

Using the diaphragm of the stethoscope, listen to the movement of air through the airways during inspiration and expiration. Instruct the patient to take deep breaths through their mouth. Listen through the entire respiratory cycle because different sounds may be heard on inspiration and expiration. As you move across the different lung fields, the sounds produced by airflow vary depending on the area you are auscultating because the size of the airway changes.

LIFE-STAGE CONTEXT

Respiratory Assessment of Children

There are various respiratory assessment considerations that should be noted with assessment of children including the following:

- The respiratory rate in children less than 12 months of age can range from thirty to sixty breaths per minute, depending on whether the infant is asleep or active.
- Infants have irregular or periodic newborn breathing in the first few weeks of life; therefore, it is important to count the respirations for a full minute. During this time, you may notice periods of apnea lasting up to ten seconds. This is not abnormal unless the infant is showing other signs of distress. Signs of respiratory distress in infants and children include nasal flaring and sternal or intercostal retractions.
- Up to three months of age, infants are considered "obligate" nose-breathers, meaning their breathing is primarily through the nose.
- The anteroposterior-transverse ratio is typically 1:1 until the thoracic muscles are fully developed around six years of age.

Normal Breath Sounds

Before auscultating the lungs, it is important to be familiar with normal breath sounds so you can compare them to any abnormal sounds heard during the assessment. Table 23.6 describes the different types of normal breath sounds and where they can be heard.

Type	Anatomical Location	Description
Bronchial breath sounds	Over trachea and larynx	• High-pitched and loud • Last longer during expiration than inspiration
Bronchovesicular breath sounds	Over the major bronchi (near first and second intercostal spaces)	• Medium-pitched • Have a pause between inspiration and expiration
Vesicular breath sounds	Throughout lung fields	• Lower-pitched • Soft quality • Heard throughout entire breath cycle

TABLE 23.6 Types of Normal Breath Sounds Heard at Anatomical Locations

LINK TO LEARNING

Normal bronchial, bronchovesicular, and vesicular breath sounds (https://openstax.org/r/77normbronch) can be heard in this video.

Adventitious Breath Sounds

Adventitious lung sounds are sounds heard in addition to normal breath sounds. They most often indicate an airway problem or disease, such as accumulation of mucus or fluids in the airways, obstruction, inflammation, or infection. These sounds include rales/crackles, rhonchi, wheezes, stridor, and pleural rub (Table 23.7).

Type	Description	Causes
Fine crackles (rales)	Intermittent high-pitched popping or crackling sounds heard on inspiration	Conditions that cause fluid accumulation in the alveoli and interstitial spaces (e.g., pneumonia or congestive heart failure)
Coarse crackles	Intermittent, low-pitched gurgling sounds heard on inspiration; lungs sound "wet"	Conditions that cause fluid accumulation in the alveoli and interstitial spaces (e.g., pneumonia or congestive heart failure)
Rhonchi	Continuous, low-pitched, whistling-type noises produced during expiration (sometimes during inspiration)	Conditions that cause narrowing of large airways (bronchoconstriction) or mucosal edema (e.g., bronchitis)
Wheeze	Continuous, high-pitched, whistling-type noises produced during expiration (sometimes during inspiration)	Conditions that cause narrowing of small airways (bronchoconstriction) or mucosal edema (e.g., asthma)
Stridor	High-pitched "crowing" sound heard only on inspiration	Mechanical obstruction at the level of the trachea or upper airway that is life-threatening if left untreated
Friction rub	Grating sound heard on either inspiration or expiration	Inflammation of the lung pleura that causes friction when the surfaces rub together (e.g., pleuritis)

TABLE 23.7 **Types of Adventitious Breath Sounds**

LINK TO LEARNING

At this website you can hear examples of adventitious breath sounds (https://openstax.org/r/77advbrthsnd) in a patient.

Assessment of Respiration Patterns

In addition to listening to breathing sounds, it is important to assess the patient's breathing pattern. A normal breathing pattern for adults consists of twelve to twenty breaths per minute that result in full lung expansion, as evidenced by adequate chest rise and fall. The chest rise should be symmetrical on both sides and the patient should look comfortable, without the use of accessory muscles during breathing. There are several abnormal breathing patterns you should assess for, with the most common types described in Table 23.8.

Breathing Pattern	Description
Agonal breathing	• Irregular, labored breathing with gasping • Often occurs in patients with brain injury and can be a sign of an underlying life-threatening condition and/or beginning of cardiac arrest
Apnea	• Temporary cessation of breathing • If apnea occurs during sleep, it is called **obstructive sleep apnea (OSA)**

TABLE 23.8 **Types of Abnormal Breathing Patterns**

Breathing Pattern	Description
Bradypnea	• Slower than normal respiratory rate (fewer than twelve breaths per minute in adults) at rest
Cheyne-Stokes respiration	• Cyclical breathing pattern involving periods of apnea and hyperventilation • Occurs most often at end of life
Dyspnea	• Difficult breathing or labored breathing pattern • Patient feels short of breath or reports being "unable to catch my breath" • Involves sensations of air hunger • A specific type, called **paroxysmal nocturnal dyspnea (PND)**, occurs abruptly during the night, usually waking the patient from sleep
Kussmaul respiration	• Deep, rapid breaths • Occurs in conditions that cause metabolic acidosis (e.g., diabetic ketoacidosis or salicylate poisoning)
Orthopnea	• Difficulty breathing when lying flat • Patients tend to sleep in recliners or in more upright sleeping positions to find relief • Associated with congestive heart failure
Tachypnea	• Faster than normal respiratory rate (more than twenty breaths per minute in adults) at rest

TABLE 23.8 **Types of Abnormal Breathing Patterns**

LINK TO LEARNING

Watch this video for examples of abnormal breathing patterns (https://openstax.org/r/77abnbrthpat) in patients.

Nursing Assessment of the Lungs

While nursing assessment of the lungs should focus on thorax configuration, breath sounds, and breathing pattern, other parameters should be assessed simultaneously, including

- skin color (cyanosis or pallor may be an indicator of inadequate gas exchange);
- pain with breathing,
- use of accessory muscles, and
- finger clubbing.

These parameters are discussed in more detail in Chapter 18 Oxygenation and Perfusion.

Identification of Complications in Lung Function

During the nursing assessment, identification of complications in lung function should be noted. There are many common disorders that can negatively affect the respiratory system (Table 23.9).

Disorder	Description	Associated Assessment Findings
Atelectasis	Alveoli collapse, resulting in limited air movement and gas exchange	• Chest pain • Cough • Cyanosis • Decreased chest expansion on affected side • Dyspnea • Shallow breathing pattern • Tachycardia
Bronchitis	Inflammation of the bronchial tubes, often occurring because of a respiratory infection	• Cough, usually with mucus • Dyspnea • Fatigue • History of recent respiratory infection • Symptoms of upper respiratory infection (e.g., runny nose, fever, or sore throat) • Tachycardia • Wheezing
Chronic obstructive pulmonary disease (COPD)	Chronic inflammatory condition of the airways and lungs	• "Barrel chest" • Accessory muscle use • Dyspnea • Finger clubbing (Figure 23.15) • Prolonged expiration • Pursed-lip breathing • Respiratory distress • Wheezing
Pleural effusion	Abnormal accumulation of fluid in the pleural cavity	• Cough • Diminished lung sounds on affected side • Dyspnea • Fever • Sharp chest pain that is worse with inspiration

TABLE 23.9 Assessment Findings Associated with Common Respiratory Disorders

Disorder	Description	Associated Assessment Findings
Pneumothorax	Abnormal accumulation of air in the pleural space	• Anxiety • Chest pain • Diminished breath sounds on affected side • Dyspnea • Without intervention, it may become a tension pneumothorax, which is characterized by profound hypoxia, hypotension, and deviation of the trachea from midline
Pulmonary edema	Abnormal accumulation of fluid in the lungs	• Cough with pink, frothy sputum • Crackles heard on affected side • Dyspnea • Heart murmur • Peripheral extremity edema • Tachypnea

TABLE 23.9 Assessment Findings Associated with Common Respiratory Disorders

FIGURE 23.15 Finger clubbing occurs with chronic conditions that involve inadequate oxygenation. (credit: modification of "ClubbingFingers1.jpg" by Ann McGrath/Wikimedia Commons, Public Domain)

CLINICAL JUDGMENT MEASUREMENT MODEL

Evaluate Outcomes: Documentation of Lung Assessment

After performing a thorough lung assessment, the nurse will document findings in the medical record. Examples of documented assessments are as follows:

Sample documentation of expected findings:

Patient denies cough, chest pain, or shortness of breath. Denies past or current respiratory illnesses or diseases. Symmetrical anterior and posterior thorax. Anteroposterior-transverse ratio is 1:2. Respiratory rate is 16 breaths/minute, unlabored, regular, and inaudible through the nose. No retractions, accessory muscle use, or nasal flaring. Chest rise and fall are equal bilaterally. Skin is pink, warm, and dry. No crepitus, masses, or tenderness upon palpation of anterior and posterior chest. Lung sounds clear bilaterally in all lobes anteriorly and posteriorly. No adventitious sounds. SpO2 saturation 99 percent on room air.

Sample documentation of unexpected findings:

Patient reports shortness of breath for five to six hours. Patient has labored breathing at rest. Nail beds are cyanotic. Respiratory rate is tachypneic at 32/minute with neck and abdominal accessory muscle use. Lung expansion is symmetrical. Pursed-lip breathing noted with intermittent productive cough. Reports coughing up blood-tinged green sputum for two days. Anterior and posterior chest walls have no tenderness, masses, or crepitus upon palpation. On auscultation, bilateral coarse crackles over lung bases. Expiratory wheezes are audible and heard with stethoscope scattered throughout lung fields. Pulse oximetry 93 percent on room air.

Cultural and Genetic Variations

Historically, studies have indicated that there are differences in lung capacity and function between different races and ethnicities. However, recent studies suggest that while race and ethnicity may have a small influence on lung function, they are not the only determining factors (Braun, 2015). It is more likely a combination of complex environmental, biological, and social factors that determine lung capacity and function. Genetics, however, play a large role in determining lung capacity and function. Several different genes and mutations have been linked to various respiratory disorders and lung cancers. Additionally, studies have shown significant differences in lung function between sexes. For example, respiratory disorders including asthma, COPD, and pulmonary hypertension, are more common and severe in females (Silveyra et al., 2021).

Behavioral and Lifestyle Variations

The biggest risk factor for developing respiratory disorders is tobacco use and smoking. In fact, patients who smoke are twelve times more likely to die from COPD than patients who do not smoke (Centers for Disease Control and Prevention, 2021). Other behavioral and lifestyle factors that increase the risk for developing respiratory disorders include

- sedentary lifestyle,
- substance abuse (e.g., drugs, alcohol), and
- occupational exposure to air pollution.

23.4 Breast and Lymphatic System

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Recognize the structure and function of the breast and the lymphatic system
- Remember how to perform a nursing assessment of the breast and the lymphatic system
- Examine common abnormalities in the breast and the lymphatic system assessment

The **immune system** is the complex collection of cells and organs that destroys or neutralizes pathogens that would otherwise cause disease or death. For most people, the **lymphatic system** is associated with the immune system to such a degree that the two systems are virtually indistinguishable. The lymphatic system is the system of vessels, cells, and organs that carries excess fluids to the bloodstream and filters pathogens from the blood. The swelling of a **lymph node** during an infection and the transport of lymphocytes via the lymphatic vessels are but two examples of the many connections between these critical organ systems. Breast tissue contains a large network of lymphatic vessels and nodes, which is why the breasts and the lymphatic system are discussed together here.

Structure and Function of the Lymphatic System

A major function of the lymphatic system is to drain body fluids and return them to the bloodstream. Blood pressure causes leakage of fluid from the capillaries, resulting in the accumulation of fluid in the **interstitial space**—that is, spaces between individual cells in the tissues. In humans, 5.3 gal (20 L) of plasma are released into the interstitial space of the tissues each day due to capillary filtration. Once this filtrate is out of the bloodstream and in the tissue spaces, it is referred to as interstitial fluid. Of this, 4.5 gal (17 L) are reabsorbed directly by the blood vessels. But what happens to the remaining 0.8 gal (3 L)? This is where the lymphatic system comes into play. It drains the excess fluid (lymph) and empties it back into the bloodstream via a series of vessels and ducts (Figure 23.16). Once the interstitial fluid has entered the lymphatic system, it's called **lymph**. When the lymphatic system is damaged in some way, such as by being blocked by cancer cells or destroyed by injury, protein-rich interstitial fluid accumulates (sometimes "backs up" from the lymph vessels) in the tissue spaces, and may lead to serious medical consequences.

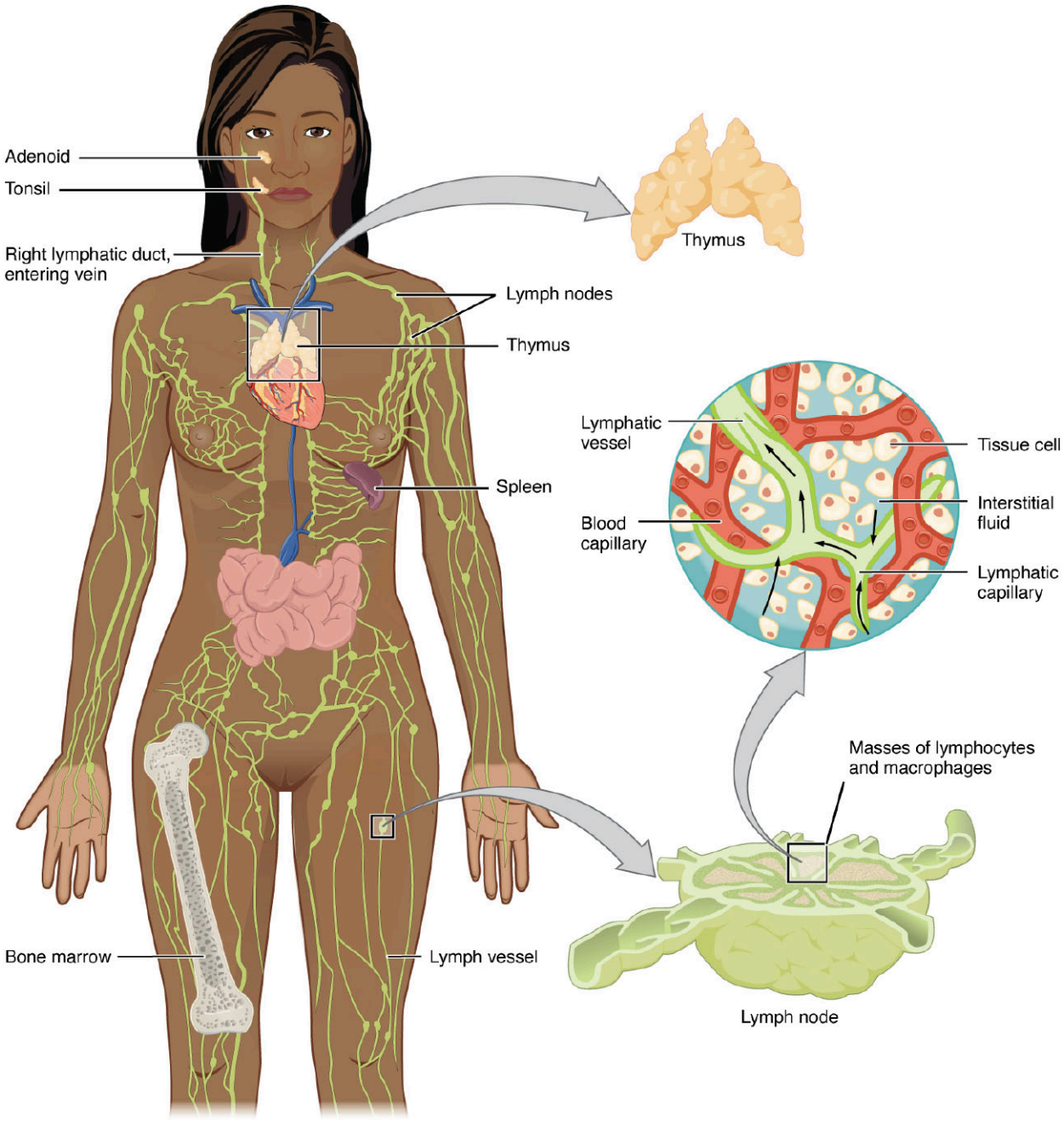


FIGURE 23.16 In this anatomy of the lymphatic system, note the network of lymphatic vessels within the breast tissue. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Lymph Nodes

Cells of the immune system not only use lymphatic vessels to make their way from interstitial spaces back into the circulation, but they also use lymph nodes as major staging areas for the development of critical immune responses. A lymph node is one of the small, bean-shaped organs located throughout the lymphatic system.

Structure and Function of the Breast

The breasts are part of the female reproductive system, and their main function is to supply infants with milk for nutrition. However, for the purposes of this chapter, the focus of discussion about breasts is their relationship with the lymphatic system. As shown in Figure 23.16, the breasts contain a large network of lymphatic vessels and nodes. This is significant because the lymphatic system is involved in the spread, or **metastasis**, of breast cancer. More information about this phenomenon is discussed later in this chapter.

External Breast Anatomy

The external features of the breast include a nipple surrounded by a pigmented areola (Figure 23.17). The areola is typically circular and can vary in size from 1 to 4 in (25 to 100 mm) in diameter. The areolar region is characterized by small, raised areolar glands that secrete lubricating fluid during lactation to protect the nipple from chafing. When a baby nurses, or draws milk from the breast, the entire areolar region is taken into the mouth.

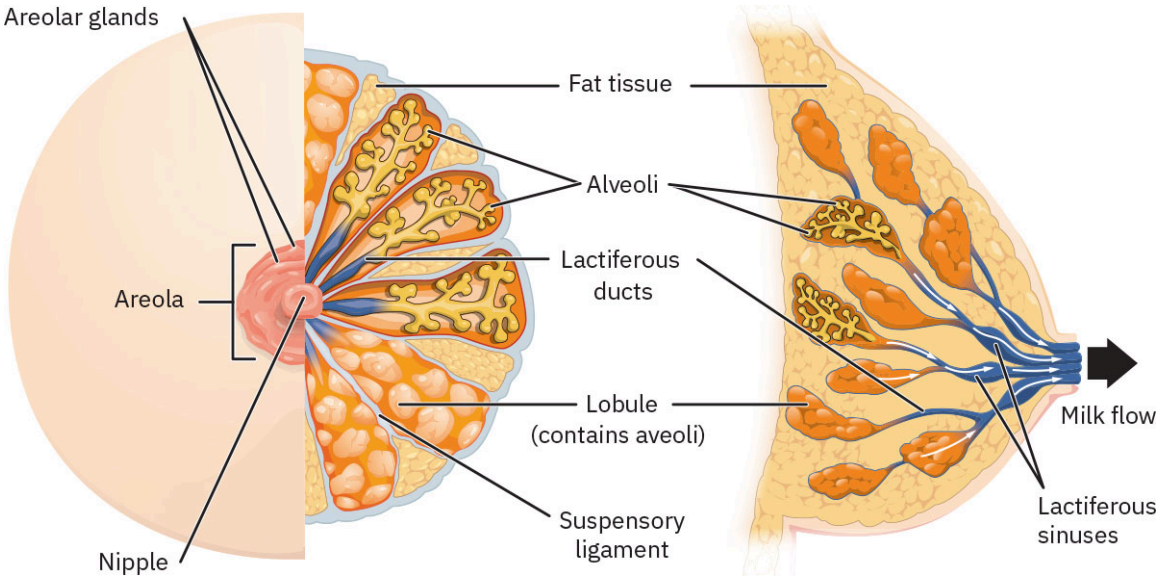


FIGURE 23.17 During lactation, milk moves from the alveoli through the lactiferous ducts to the nipple. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Internal Breast Anatomy

Breast milk is produced by the **mammary glands**, which are modified sweat glands. The milk itself exits the breast through the nipple via fifteen to twenty **lactiferous ducts** that open on the surface of the nipple. These lactiferous ducts each extend to a **lactiferous sinus**, which connects to a glandular lobe within the breast itself that contains groups of milk-secreting cells in clusters called **alveoli** (Figure 23.17). The clusters can change in size depending on the amount of milk in the alveolar lumen. Once milk is made in the alveoli, myoepithelial cells that surround the alveoli contract to push the milk to the lactiferous sinuses. From here, the baby can draw milk through the lactiferous ducts by suckling. The lobes themselves are surrounded by fat tissue, which determines the size of the breast; breast size differs between individuals and does not affect the amount of milk produced. Supporting the breasts are multiple bands of connective tissue called suspensory ligaments that connect the breast tissue to the dermis of the overlying skin.

Because of the large network of lymphatic vessels and nodes located within the breast tissue, the lymphatic system plays a big role in the development of breast cancer. Cancerous cells that arise within the breast tissue are easily carried through the lymphatic system into nearby lymph nodes as well as other distant sites through metastasis. Breast cancer is the most commonly diagnosed cancer in women, so this underscores the importance of the nurse conducting a thorough breast assessment for early detection (Rinaldi et al., 2023).

Nursing Assessment of Breasts and Lymphatic System

Assessment of the breast and lymphatic system focuses on early detection of abnormalities (e.g., lumps or masses) in the breast that may be indicative of cancer. Additionally, nearby and distant lymph nodes should be assessed for abnormalities that may indicate the spread of cancer or development of an infection.

Collecting Subjective Data

Collection of subjective data begins with a patient interview to collect a health history and any other pertinent information from the patient directly. During the interview, the nurse should make note of any risk factors for breast cancer including

- age over 50,
- family or personal history of breast or ovarian cancer,

- known genetic mutations (e.g., BRCA1 or BRCA2),
- early onset (before age 12) menstruation and/or late menopause (after age 55),
- first pregnancy after age 30 and/or not breastfeeding,
- alcohol use,
- sedentary lifestyle,
- having a higher weight, and
- history of or currently using hormone replacement therapy.

The nurse should ask the patient how often (if at all) they are performing self-breast exams. And if they are doing them regularly, it is important to ask the patient if they have felt any abnormal lumps or masses in the breasts. Any mention of a new lump or mass should be investigated further by the nurse during the interview. It is important to ask how long ago the patient noticed the mass, how large it is, if it is firm or soft, and if the patient is experiencing any other symptoms such as fever or swollen lymph nodes. After collecting this information, the nurse should relay it to the treating clinician as soon as possible to ensure quick follow-up and treatment, if indicated.

PATIENT CONVERSATIONS

Subjective Interview with Patient at Risk for Breast Cancer

Scenario: Nurse is performing a physical assessment on a 56-year-old patient being seen in the clinic for an annual wellness exam. The patient expresses concern about developing breast cancer, as her older sister was just diagnosed.

Nurse: Hi, my name is Anna, and I'll be your nurse today. I see that you're here for an annual checkup. Before we get started, do you have any specific concerns you'd like to discuss?

Patient: Hi, Anna. It's nice to meet you. My sister was actually just diagnosed with stage 3 breast cancer and I'm terrified that's going to happen to me too. Am I at higher risk since she has it?

Nurse: I'm so sorry to hear about your sister. I know that must be difficult for her and for you. While there is a genetic component, that doesn't necessarily guarantee that you will get it too. Can I ask you a few questions to get a better idea of any risk factors you might have?

Patient: Sure, go ahead.

Nurse: You mentioned that your sister was recently diagnosed. Has anyone else in your family been diagnosed with breast or ovarian cancer?

Patient: No one else has had breast cancer but my maternal grandmother died from ovarian cancer.

Nurse: I'm so sorry about that. Have any providers ever talked to you about getting genetic testing done?

Patient: I feel like a long time ago someone mentioned it, but they never followed through with more information about it and I had forgotten about it until my sister was diagnosed.

Nurse: I'll make a note here in your chart so that the provider can give you some more information about the testing and we will be sure that we follow through on it if you decide it's something you want to do. Do you remember how old you were when you got your first period?

Patient: Oh gosh that was forever ago. Maybe 12 years old? Why does that matter?

Nurse: Sometimes women who get periods early or go through menopause later than usual are at higher risk for breast cancer because they are exposed to the female hormone, estrogen, for longer periods of time.

Patient: Oh, that makes sense. Well for what it's worth, I'm 56 and still haven't gone through menopause. Should that worry me?

Nurse: Not necessarily but I'll note it in your chart for future reference. Can you tell me about your lifestyle? How is your diet and do you exercise regularly?

Patient: I walk a few miles every morning before work but I won't lie, my diet isn't the healthiest.

Nurse: Can you expand on that a little? What does unhealthy eating mean to you?

Patient: I eat out for most meals because I work long hours. I've been trying to be better about prepping my meals but it's often just easier to grab fast food on the way home.

Nurse: I get it for sure, but making good choices about food can be a great way to stay generally healthy and possibly prevent cancer and other diseases. How about alcohol? Do you drink at all?

Patient: Nope, hardly ever. Occasionally, like once a month, I might have a glass of wine but that's it. I don't like the way it makes me feel.

Nurse: Got it. Do you ever perform self-breast exams at home?

Patient: I never have. At least not until my sister was diagnosed with cancer. She never did them either. Her doctor felt it at her checkup.

Nurse: I see. I will perform an exam today after we finish this interview and I can show you how to perform them yourself at home so you can start doing it on your own. Does that sound okay?

Patient: Yes, that sounds great. I want to do everything I can to prevent getting breast cancer. Thank you!

Collecting Objective Data

Objective data are collected during a physical assessment of the breast and lymphatic system. The nurse first performs a visual inspection of the breasts and lymphatic system and then moves to palpation. Expected assessment findings for each of these techniques are listed in Table 23.10 and Table 23.11.

Technique	Expected Findings
Inspection: • Position patient seated, facing the examiner • Breasts should be assessed with patient sitting normally with hands at their side, with hands on their hips, and with hands raised above their head	• Breasts should be similar in size and shape, though it is normal to see one breast slightly smaller than the other • Skin over breasts should be smooth, without evidence of dimpling or skin thickening
Palpation: • Patient should be moved into a supine position with arms raised up for this part of the exam • Keep other breast covered when not being palpated to provide privacy and promote comfort • Examiner uses pads of fingers with hand in a slightly cupped position to feel breasts in a circular motion • Start at one point and complete a full circle of feeling for lumps or masses.	• Breasts should feel soft without evidence of masses or nodules • Patient should not report any pain or discomfort during palpation • Nipples should be mostly symmetrical without discharge (except for lactating mothers)

TABLE 23.10 Expected Findings during a Breast Assessment

Technique	Expected Findings
Inspection: • The nurse visually assesses lymph nodes (typically the neck and axillae regions as these are easiest to see)	• No evidence of swollen lymph nodes
Palpation: • Provider uses two fingers to gently push on lymph nodes, especially those in the neck and axillary areas	• No evidence of swelling or patient-reported tenderness in lymph nodes

TABLE 23.11 Expected Findings during Lymphatic System Assessment

Abnormalities in Breasts and Lymphatic System

Abnormalities found in the breast and lymphatic system warrant further investigation by the nurse as they may be indicative of cancer or some kind of infection. Though this is not always the case, a thorough follow-up of the abnormal finding will help determine the underlying cause and initiate early intervention, if necessary. Some abnormalities may be seen visually during inspection, while others are not visible to the eyes but can be felt during palpation.

Abnormalities Noted on Inspection

Visual inspection of the breasts should be performed bilaterally as abnormalities are often found only on one side. Abnormal asymmetric findings during inspection of the breasts include the following:

- variations in breast size (note that this can be normal in many cases)
- skin color changes
- skin "dimpling" (skin looks like an orange peel) or retractions (Figure 23.18)
- spontaneous nipple discharge
- obvious mass (note that these are not usually visible without palpation unless they are large)
- rash around the nipple or areola
- sunken nipple

FIGURE 23.18 The right breast has a "dimpled" pattern that resembles the skin of an orange, which could be indicative of breast cancer or other underlying conditions. (credit: "cancers-02-00143-f001" by National Library of Medicine, CC BY 3.0)

During inspection of the lymphatic system, the nurse should look for any obvious areas of lymph node swelling, also known as **lymphadenopathy** (Figure 23.19). Swollen lymph nodes may indicate that the patient has an infection of some kind or, more rarely, that some kind of cancer has spread to the lymphatic system.

FIGURE 23.19 An enlarged cervical lymph node can be seen and palpated on the neck. (credit: modification of "Ixodholfem8.jpg" by Bernard Hudson/Wikimedia Commons, CC BY 3.0)

Another abnormality of the lymphatic system that can be seen during inspection is called **lymphedema**, which is an accumulation of protein-rich interstitial fluid in the tissue spaces because of lymphatic system blockage or damage (Figure 23.20). Causes of lymphedema include infection, cancer, scar tissue from radiation therapy, surgical removal of lymph nodes, or inherited conditions. There is no cure for lymphedema, but elevation of the affected extremity is vital. It is also important to remember to avoid taking a blood pressure measurement on a patient's extremity with lymphedema.

(a) (b)

FIGURE 23.20 (a) A patient exhibits lymphedema of the left lower extremity, and (b) a patient exhibits lymphedema of the upper extremities. (credit: "Patient photographs (A) Illustrating bilateral lower extremity lymphedema greater on the left. (B) Patient 2, showing right upper extremity lymphedema." by National Library of Medicine, CC BY 3.0)

Abnormalities Noted on Palpation

Palpation of the breast and lymphatic system is vital, as it provides much more information about the patient's condition than a simple visual inspection. While palpating the breasts, the nurse should feel for any abnormal lumps or masses, which could possibly indicate the development of breast cancer. If a lump or mass is present, the nurse should attempt to describe its characteristics. Specifically, the nurse should note if the mass is soft or hard and if the mass is mobile, meaning it is easily able to be moved between the fingers. There is no "typical" type of mass specifically associated with breast cancer, so any abnormal mass should be reported to the provider immediately so that appropriate follow-up and evaluation can be initiated. In addition to palpating for masses, the nurse should also feel the skin on the breast to make sure that it is warm, dry, and intact. Any dryness, redness, open sores, or edema should be noted in the patient's record and investigated further. When palpating the lymph nodes, the nurse will note any swelling or hard lumps felt. Lymph nodes most commonly affected are those in the neck and axillary regions, so the nurse should focus the assessment in these areas. Any swelling or tenderness of the lymph nodes should be documented and reported to the provider so that further investigation can be conducted.

LIFE-STAGE CONTEXT

Breast Cancer Screening Guidelines for Women

According to the American Cancer Society (2022), the following general screening guidelines are recommended for women of various ages and life stages:

- Women between ages 40 and 44 have the option to start annual mammograms.
- Women between age 45 and 54 should get mammograms annually.
- Women 55 and older can switch to getting mammograms every other year or continue getting them annually. Screenings should continue if the woman is in good health and expected to live at least ten more years.

For women at high risk (typically based on family history and genetic factors), a breast MRI and mammogram should be done every year beginning at age 30.

Summary

23.1 Structure and Function

The major structures of the thorax include the thoracic cage and the thoracic cavity. The thoracic cage is comprised of ribs, sternum, and clavicles; its function is to protect the thoracic cavity. The thoracic cavity is comprised of the trachea, lungs, and pleural membranes; its primary function is to support breathing. This is done through inspiration, expiration, and the exchange of gases. The mechanism of breathing and pulmonary ventilation is dependent on various pressure gradients within and outside of the lungs, such as a patient's lung volume or capacity. The muscles and structures of one's thorax also play a big part in determining if a patient's breathing is effective or efficient. Because all organs and tissues require oxygen to function optimally, it is vital that pulmonary ventilation and oxygen transport mechanisms are working properly. By measuring various respiratory parameters (volumes and capacities), the nurse can get a good picture of the overall function of the patient's respiratory system.

23.2 Physical Assessment of the Thorax

With an understanding of the basic structures and primary functions of the thorax, the nurse collects subjective and objective data to perform a focused chest assessment. The nurse can collect subjective data during the focused thorax assessment by using interview questions, paying particular attention to what the patient is reporting. The information discovered during the interview process guides the physical exam and subsequent patient education. A focused thorax and respiratory objective assessment includes interpretation of vital signs, inspection of the patient's breathing pattern, skin color, and respiratory status, palpation to identify abnormalities, and auscultation of lung sounds using a stethoscope. Abnormal findings during the thorax assessment may include prolonged expiration, tripod positioning, barrel chest, kyphosis, or unequal chest expansion.

23.3 Breath Sounds and Lung Assessment

Auscultation of the lungs is one of the most important aspects of a focused respiratory assessment. With practice, you will become proficient at determining whether the sounds you are hearing are normal or if they are indicative of an underlying medical condition. Abnormal sounds include fine or course crackles, rhonchi, wheezes, stridor, or even friction rubs. Additionally, there are many abnormal breathing patterns for which the nurse should monitor, such as dyspnea, orthopnea, bradypnea, tachypnea, agonal breathing, apnea, and Kussmaul or Cheyne-Stokes respirations. Abnormal lung sounds in combination with abnormal breathing patterns may indicate underlying diseases such as atelectasis, bronchitis, COPD, pleural effusion, pneumothorax, or pulmonary edema. Nurses being able to distinguish sounds and recognize patterns is helpful for recognizing and analyzing potential complications and effectively caring for the patient.

23.4 Breast and Lymphatic System

The lymphatic system is a part of the immune system. The structures of the lymphatic system are composed of cells and organs that destroy or neutralize pathogens that would otherwise cause disease or death. The structure of the breasts includes a large network of lymphatic vessels and nodes. The function of the breast is to support the lymphatic system. These two are often assessed at the same time because there are several nearby lymph nodes and vessels. Assessment of these parts includes visual inspection and palpation, with the nurse noting any abnormalities, including asymmetrical sizes or shapes, swelling, or masses. Any abnormal findings should be communicated to the provider immediately, as they may be indicative of cancer, diseases, or infection.

Key Terms

adventitious occurring in an unusual place or manner
agonal breathing irregular, labored breathing with gasping
alveoli clusters of milk-secreting cells located within the breast
apnea the cessation of breathing
atelectasis the collapse of alveoli in the lungs, resulting in limited air movement and decreased gas exchange
bradypnea a slower-than-normal respiratory rate (fewer than twelve breaths per minute in adults) at rest
bronchitis inflammation of the bronchial tubes, often occurring secondary to a respiratory infection
Cheyne-Stokes respiration a cyclical breathing pattern involving periods of apnea and hyperventilation that often occurs at end of life

chronic obstructive pulmonary disease (COPD) a chronic inflammatory condition of the airways and lungs
clavicular notch the shallow depression located on either side at the superior-lateral margins of the manubrium
coarse crackles intermittent, low-pitched gurgling sounds heard on inspiration
crepitus a popping or crackling sensation when the skin is palpated; it is a sign of air trapped under the subcutaneous tissues
dyspnea difficult, labored breathing pattern
expiration the movement of air out of the lungs
facet the articulation site where the rib attaches to the thoracic vertebrae
fibroelastic membrane a flexible membrane that closes the posterior surface of the trachea, allowing it to stretch and expand slightly during inhalation and exhalation
fine crackles (rales) intermittent high-pitched popping or crackling sounds heard on inspiration
friction rub a grating sound heard on either inspiration or expiration
hilum the concave region where blood vessels, lymphatic vessels, and nerves enter the lungs
immune system a complex collection of cells and organs that destroys or neutralizes pathogens that would otherwise cause disease or death
inspiration the movement of air into the lungs
interstitial space the area between individual cells in the tissues
jugular (suprasternal) notch the shallow, U-shaped border at the top of the manubrium of the sternum between the medial ends of the clavicles
Kussmaul respiration a deep, rapid breathing pattern associated with metabolic acidosis
lactiferous ducts milk-secreting openings located on the surface of the nipple
lactiferous sinus a glandular lobe within the breast itself that contains groups of milk-secreting cells
lymph interstitial fluid that has entered the lymphatic system
lymph node a small bean-shaped organ that composes part of the lymphatic system
lymphadenopathy swelling of the lymph nodes
lymphatic system system of vessels, cells, and organs that carry excess fluids to the bloodstream and filter pathogens from the blood through lymph nodes
lymphedema accumulation of protein-rich interstitial fluid in the tissue spaces as a result of lymphatic system blockage or damage
mammary glands modified sweat glands located in the breasts that makes breast milk
manubrium the wider, superior portion of the sternum
metastasis the spread of cells to a distant site, such as with cancer cells
obstructive sleep apnea (OSA) a cessation of breathing that occurs during sleep
orthopnea difficulty breathing when lying flat
parietal pleura the outermost pleural membrane layer that connects to the thoracic wall, mediastinum, and diaphragm
paroxysmal nocturnal dyspnea (PND) dyspnea that occurs abruptly during the night, usually waking the patient from sleep
pleura the double-layered serous membrane that surrounds each lung
pleural cavity the compartment enclosing the lung, created by the visceral and parietal membrane layers
pleural effusion an abnormal accumulation of fluid in the pleural cavity
pneumothorax an abnormal accumulation of air in the pleural space
pulmonary edema a buildup of fluid in the veins and alveoli of the lungs caused by the inability of the heart to adequately circulate blood
respiratory capacity the combination of two or more selected respiratory volumes, which further describes the amount of air in the lungs during a given time
respiratory volume the amount of air moved by or associated with the lungs at a given point in the respiratory cycle
retraction the "pulling in" of muscles between the ribs or in the neck when breathing, indicating difficulty breathing or respiratory distress
rhonchi continuous, low-pitched whistling-type noises produced during expiration (sometimes during inspiration)
sternoclavicular joint the site where the clavicle and sternum are attached
sternum the elongated bony structure that anchors the anterior thoracic cage

stridor a high-pitched "crowing" sound heard only on inspiration
tachypnea a respiratory rate that exceeds 20 breaths per minute
thoracic cage the anatomical structure that includes the twelve ribs and sternum
thorax the area of the body commonly known as the chest
total lung capacity (TLC) the sum of all the lung volumes
trachea the lowest structure of the upper airway, adjacent to the esophagus, that connects the lung bronchi and the larynx and provides a route for air to enter and exit the lungs; also known as the windpipe
visceral pleura the innermost pleural membrane layer that lies superficial to the lungs
wheeze a continuous, high-pitched whistling-type noise produced during expiration (sometimes during inspiration)
xiphoid process the inferior tip of the sternum

Assessments

Review Questions

1. The nurse is explaining the anatomy of the thorax to a group of nursing students. What statement, if made by a student nurse, would indicate an understanding of thoracic anatomy?
   a. "There are five thoracic vertebrae in total."
   b. "The xiphoid process is the superior tip of the sternum."
   c. "The main function of the thoracic cage is to protect the thoracic cavity."
   d. "The larynx is also commonly called the windpipe."

2. What part of the lungs is the site where gas exchange occurs?
   a. primary bronchi
   b. alveoli
   c. pulmonary artery
   d. carina

3. What is an accurate statement about pressure relationships and breathing mechanics?
   a. Air flows from areas of lower pressure to higher pressure in pulmonary ventilation.
   b. Higher transpulmonary pressure results in a smaller, less inflated lung.
   c. Intrapleural pressure undergoes significant fluctuations during the breathing cycle.
   d. Intra-alveolar pressure will always equalize with atmospheric pressure.

4. What should a nurse say to a patient who asks what the tidal volume (TV) measurement means?
   a. "Tidal volume is the amount of air that enters your lungs when you're quietly breathing."
   b. "This measurement shows the amount of air that you can exhale after a normal breath."
   c. "Tidal volume is the extra amount of air that you can bring into the lungs during a forced inspiration of air."
   d. "This will show how much air is left in your lungs after you exhale as much air as possible."

5. The nurse is preparing to obtain the inspiratory capacity (IC) on a patient. What parameters will the nurse use to obtain this information?
   a. functional residual capacity and tidal volume
   b. tidal volume and inspiratory reserve volume
   c. sum of all volumes except residual capacity
   d. expiratory and inspiratory reserve volumes

6. The nurse is obtaining a health history on a patient during a focused respiratory assessment. What information provided by the patient would the nurse note as being a potential risk factor for the development of chronic respiratory disorders?
   a. occasional alcohol use
   b. getting a flu shot annually

c. BMI of 25
d. working a sedentary job

7. The nurse is performing a focused thorax physical assessment on a patient. What finding does the nurse anticipate?
a. asymmetrical chest rise and fall
b. anteroposterior-transverse ratio of 1:1
c. twenty-five breaths noted per minute
d. inspiration that is shorter than expiration

8. The nurse is caring for a patient admitted for a COPD exacerbation. What assessment finding would indicate that the condition is becoming more severe?
a. oxygen saturation of 92%
b. patient has outward curvature of the spine
c. intercostal retractions are noted
d. patient breathing rate of eighteen breaths a minute

9. The nurse observes that a patient has unequal chest expansion during an assessment. What condition does the nurse most suspect the patient has?
a. kyphosis
b. barrel chest
c. fractured ribs
d. emphysema

10. The nurse is caring for a patient with COPD. What anteroposterior-transverse chest ratio would be most consistent with the patient's condition?
a. 1:1
b. 1:2
c. 2:1
d. 1:3

11. The nurse is precepting a student nurse and observing the student perform a focused respiratory assessment. What observation would warrant intervention by the nurse?
a. The student nurse places the stethoscope directly on the patient's skin.
b. The student nurse positions the patient in a supine position while listening to the lungs.
c. The student nurse listens in a side-to-side pattern over the chest and back.
d. The student nurse listens in twelve different places on the patient's chest.

12. The nurse is auscultating a patient's lungs and notices a high-pitched, loud sound over the trachea. What breathing sound is the nurse most likely hearing?
a. vesicular
b. stridor
c. bronchial
d. bronchovesicular

13. The nurse is auscultating a patient's lungs and hears wheezes on inspiration. What condition is the most consistent with these findings?
a. pneumonia
b. asthma
c. congestive heart failure
d. pleuritis

14. The nurse is obtaining a health history on a new patient. The patient reports having difficulty sleeping flat and

sleeps in the recliner most nights. How would the nurse document this information in the chart?

a. bradypnea
b. tachypnea
c. apnea
d. orthopnea

15. The nurse is caring for a patient with a history of COPD. What lung sounds would the nurse most anticipate?

a. bradypnea
b. friction rub
c. stridor
d. wheezing

16. The nurse is obtaining a health history on a patient being seen for a suspicious lump in the breast. What information, if provided by the patient, would the nurse recognize as a risk factor for breast cancer?

a. family history of prostate cancer
b. first menstruation cycle at age 14
c. first pregnancy at age 26
d. never breastfeeding

17. The nurse is getting ready to palpate the breasts of a patient to check for abnormal lumps. What position should the nurse place the patient in for the exam?

a. prone position
b. sitting upright in a chair
c. supine with arms raised
d. side lithotomy position

18. The nurse is providing education to a 50-year-old female about breast cancer screening. What frequency should the nurse recommend the patient get mammograms?

a. every other year
b. annually
c. annually starting at age 55
d. every six months

19. During a physical assessment, the nurse notices that the patient has swollen axillary lymph nodes. How would the nurse document these findings in the chart?

a. lymphedema
b. lymphadenopathy
c. metastatic breast cancer
d. peripheral edema

20. The nurse is explaining the role of the lymphatic system to a student nurse. What statement, if made by the student nurse, indicates an understanding of the teaching?

a. “It fights off infection in the body.”
b. “It transports blood to body organs.”
c. “It discards excess fluids and wastes.”
d. “It is part of the digestive system.”

Check Your Understanding Questions

1. How can “reference lines” be used when performing a physical assessment of the thorax?

2. What is the difference between the visceral and parietal pleura of the lungs and what is their main function in the body?

3. You are caring for a patient who reports a cough. What follow-up questions would you ask as part of the

subjective assessment?

4. What are some of the key differences between respiratory assessment findings in adults versus children?
5. What is the difference between agonal breathing, Kussmaul respirations, and apnea?
6. What is the major function of the lymphatic system and how is it involved in cancer?

Reflection Questions

1. How would you handle a situation where a patient continues to make poor health decisions (e.g., smoking when they have COPD) and shows no desire to make a change?
2. Which breath sounds and breathing patterns would be most concerning to you and why?
3. During a routine physical examination, you palpate a large mass in the patient's breast. What would you do next? How would you relay this information to the patient?

What Should the Nurse Do?

Mr. Jensen presents to the emergency department after being unable to "catch my breath" after mowing the lawn. His medical history includes asthma, COPD, and a previous heart attack. He mentions that he had a cold last week that he cannot seem to get rid of.

1. What follow-up questions would the nurse ask to obtain subjective data?
2. What assessments would the nurse perform to obtain objective data?
3. What would the nurse suspect is going on with the patient based on the provided information?

Mr. Smith is being seen in the clinic for a checkup. During the health history, he admits to smoking a pack of cigarettes daily for the last fifteen years.

4. What additional information should the nurse obtain from the patient at this point in the assessment?
5. What should the nurse assess for during the physical assessment of this patient?
6. What abnormal findings might the nurse anticipate during the assessment based on the patient's history?

Competency-Based Assessments

1. Create a color-coded diagram that highlights the main anatomical structures of the thorax.
2. Roleplay or create a script using the Five As to counsel a patient who reports vaping on a regular basis.
3. Perform a focused respiratory assessment on a peer and document your findings as a nurse's note.
4. Describe the techniques you would use to perform a breast and lymphatic examination.

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CHAPTER 24

Assessment of the Cardiovascular and Peripheral Vascular System

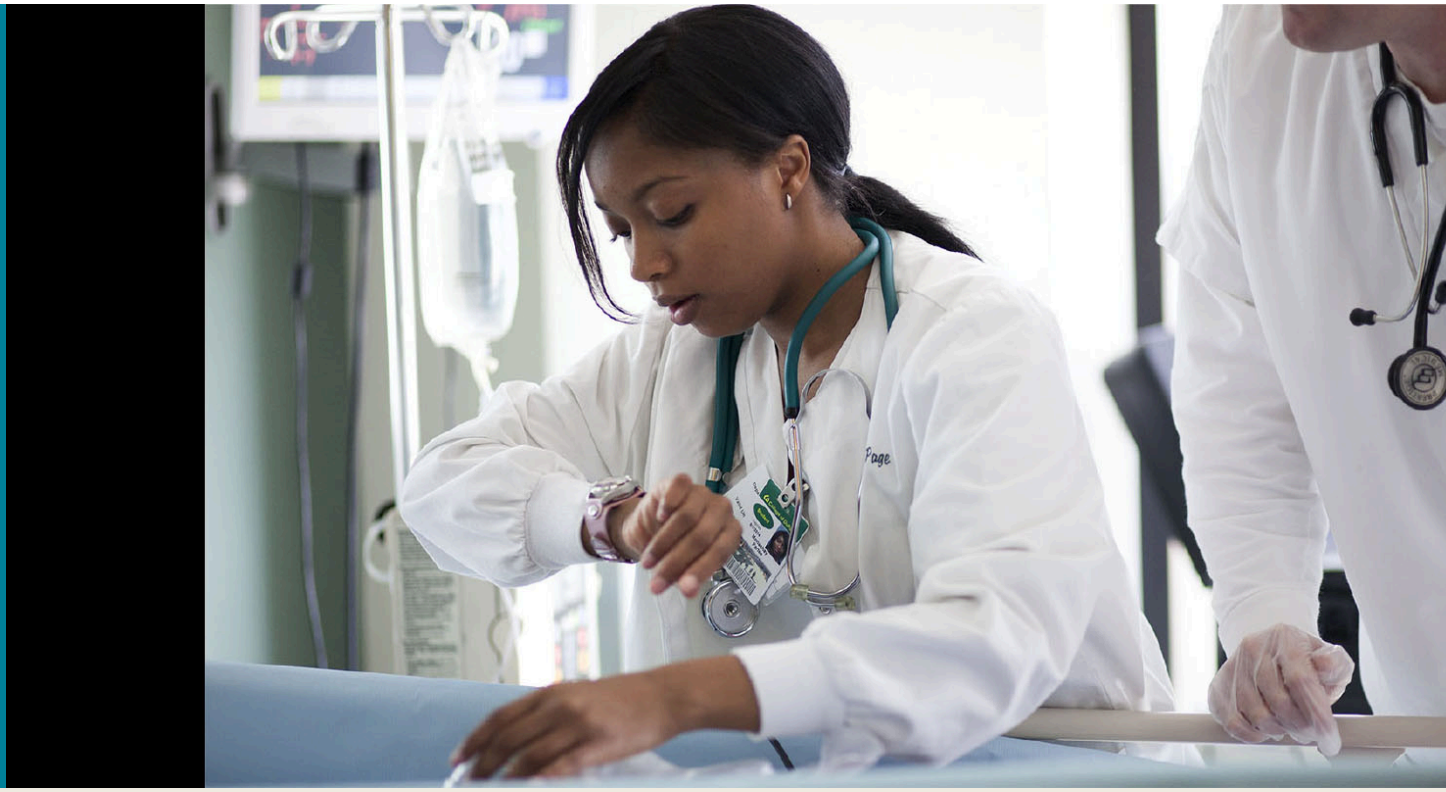

FIGURE 24.1 Providing quality and competent nursing care includes performing a comprehensive cardiovascular and peripheral vascular assessment. (credit: modification of work "EMT/Nursing Pediatric Emergency Simulation - April 2013 18" by COD Newsroom/Flickr; CC BY 2.0)

CHAPTER OUTLINE

24.1 Cardiovascular System
24.2 Peripheral Vascular System
24.3 Nursing Assessment

INTRODUCTION Heart disease continues to be the leading cause of death among men and women of all races and ethnicities (World Health Organization [WHO], 2021). The World Health Organization (WHO) reports millions of deaths each year from cardiovascular disease (CVD), such as myocardial infarction (MI) and stroke (WHO, 2021). Approximately one-third of all deaths occur before age 70, which is considered to be premature when compared to the average life span. Understanding the function of the cardiovascular and peripheral vascular systems, related pathologies, and the effect cardiovascular disease has on the body is important in ensuring appropriate diagnosis and treatment. Identifying risk factors early can facilitate early diagnosis and treatment and, therefore, contributes to a longer and healthier life span. Lifestyle factors (e.g., diet, physical activity, smoking) and comorbid disorders contribute significantly to the development and progression of cardiovascular and peripheral vascular diseases. To mitigate any potential cardiovascular risks, nurses must be skilled in conducting thorough assessments, recognizing risk factors, and implementing interventions specific to the patient.

Coronary artery disease, heart failure, valvular diseases, arrhythmias, and peripheral vascular disease are examples of the types of cardiovascular diseases the nurse will encounter. Each of these disorders manifests in various ways,

with each presenting unique challenges in diagnosing, treating, and providing ongoing care. Understanding the nuances of each disorder as well as the individual needs of the patient allows the nurse to play a pivotal role in the holistic care of the patient. Identifying the anatomy and physiology of the cardiovascular and peripheral vascular systems along with recognizing dysfunction is crucial in both prevention and management. As caregivers on the front lines of health care, a comprehensive understanding of cardiovascular and peripheral vascular diseases equips nurses with the knowledge and skills necessary to provide compassionate and effective care to individuals navigating the complexities of cardiovascular and peripheral vascular health.

24.1 Cardiovascular System

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Discuss the structures of the cardiovascular system
- Describe the functions of the cardiovascular system
- Explain cardiovascular abnormalities related to the ECG

The cardiovascular system, a magnificent physiological organ system, serves as the life-sustaining force within the human body. This intricate network consisting of the heart and blood vessels, also known as the circulatory system, coordinates an intricate network of functions to ensure the continuous flow of blood, oxygen, and nutrients throughout the body. At the core of this system lies the heart, a tireless muscle that propels blood through a complex web of blood vessels, working in tandem with various organ systems to maintain homeostasis. Primary functions needed for homeostasis are carried out via the supporting blood vessel structures, the arteries and veins.

Beyond mechanical functions, the cardiovascular system is a regulatory powerhouse, capable of adapting to the body's ever-changing demands. Hormones such as adrenaline and intricate neural signals influence heart rate and blood pressure, demonstrating the system's responsiveness to internal and external stimuli.

A primary role of the nurse is to address dysfunction within the cardiovascular system that can manifest in various ways, significantly affecting an individual's health and well-being. One prevalent example is hypertension (high blood pressure), which places increased stress on the heart and blood vessels. As a result, hypertension can lead to serious complications (e.g., heart disease, stroke, kidney damage). Nurses must be adept at monitoring blood pressure, educating patients on lifestyle modifications, and administering medications to manage hypertension and other cardiovascular diseases effectively.

Structures of the Cardiovascular System

The cardiovascular system is a sophisticated network of structures vital for sustaining life. It encompasses the heart, blood vessels, and blood, working collaboratively with other organ systems to facilitate the transportation of oxygen, nutrients, and waste to and from the body's tissues. This intricately interconnected system functions in harmony with the respiratory, lymphatic, gastrointestinal, and urinary systems to maintain homeostasis.

The heart, as the primary organ within the cardiovascular system, tirelessly pumps blood to guarantee consistent oxygenation of cells, supply of nutrients to tissues, and removal of wastes from tissues. It is divided into four chambers—two atria and two ventricles—employing a specific cardiac cycle cadence to coordinate atrial and ventricular contractions, thereby effectively circulating blood throughout the body. Simultaneously, blood vessels play a crucial role by carrying oxygenated blood to the body via arteries and returning deoxygenated blood to the heart through veins.

Blood, a pivotal component in maintaining homeostasis, ensures that blood is oxygen-rich and nutrient-laden, circulating throughout the body to vital organs. Blood is composed of red and white blood cells, platelets, and plasma. It not only facilitates oxygenation but also combats infections and aids in clotting. For nurses, a comprehensive understanding of blood composition, clotting mechanisms, and the effect of blood type on patient care is essential.

The cardiovascular system operates under intricate regulatory mechanisms, adapting to varying physiological demands. Hormones (e.g., adrenaline, angiotensin) influence heart rate and blood pressure. Nurses must fully understand how these regulatory systems promptly identify signs of instability and intervene effectively, ensuring optimal cardiovascular function. Patients often are seen for conditions such as hypertension, coronary artery

disease, heart failure, and arrhythmias. Acquiring a solid understanding of the structures and functions of the cardiovascular system equips nurses with the knowledge needed to recognize, prevent, and manage various cardiovascular conditions.

Heart Chambers and Valves

The heart is an intricately designed pump composed of four chambers and four valve structures. Understanding the anatomy and function of these chambers and valves is paramount for nursing professionals because they play a pivotal role in assessing and intervening when necessary to help the heart maintain the continuous circulation of blood throughout the body. Having a thorough understanding of the complexity of the chambers and valves will allow the nurse to create nursing care plans that provide comprehensive care to patients with disorders such as atrial fibrillation, ventricular tachycardia, and mitral stenosis.

The heart has four primary chambers, two on each side—the atria (upper chambers) and the ventricles (lower chambers) (Figure 24.2). Deoxygenated blood from the body flows into the right atrium through the superior and inferior vena cavae. The left atrium receives oxygenated blood from the lungs through the pulmonary veins. The atria serve as reservoirs, collecting blood and then contracting to propel it into the ventricles.

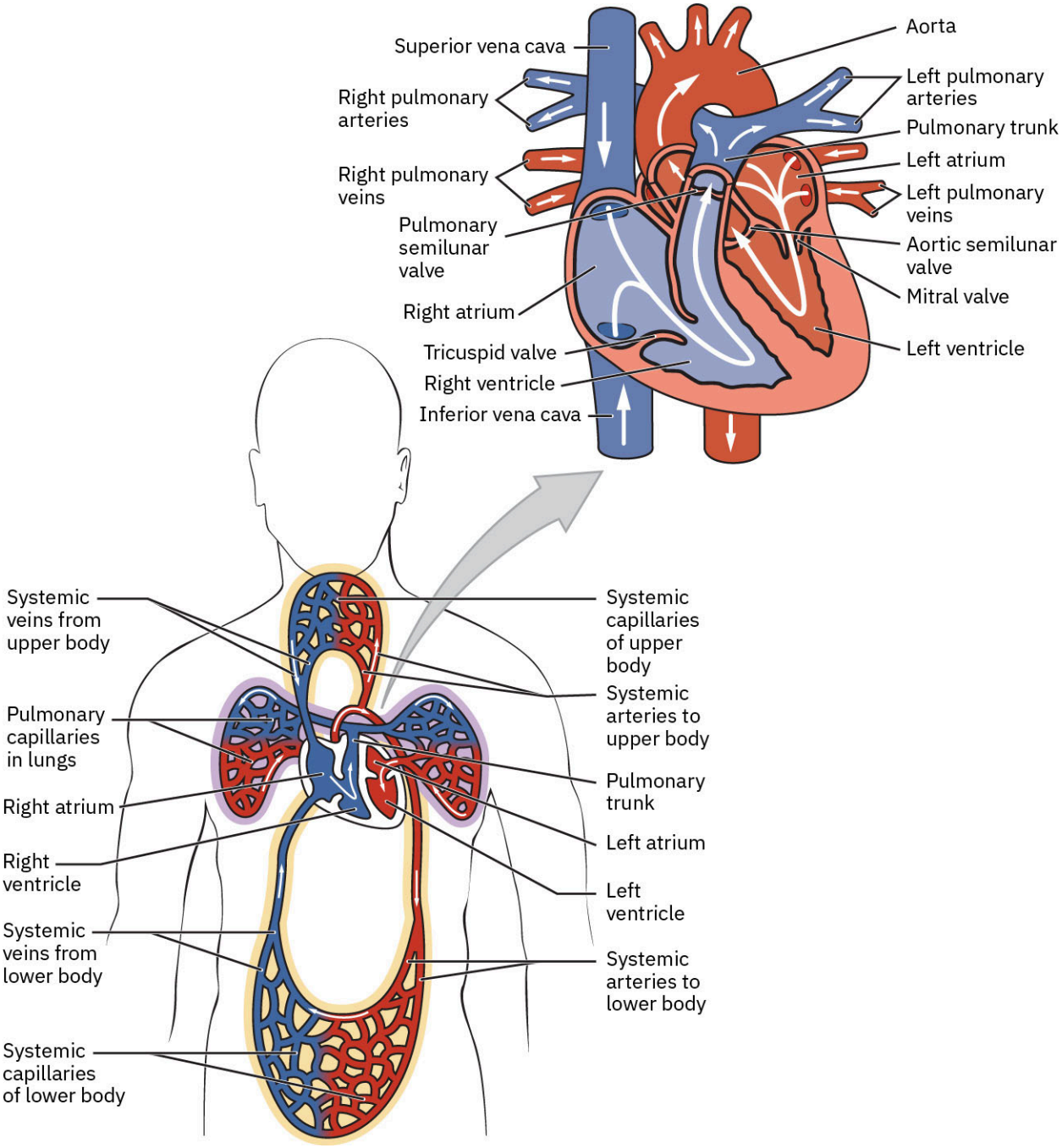

FIGURE 24.2 The heart pumps blood through the chambers and valves to ensure that blood reaches all areas of the body. The four chambers work in tandem to create a cardiac cycle cadence that works smoothly, pumping blood in and out of the heart. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

The ventricles, on the other hand, are responsible for pumping blood out of the heart. The right ventricle propels deoxygenated blood to the lungs through the pulmonary artery, where it undergoes gas exchange of carbon dioxide with oxygen. Simultaneously, the left ventricle pumps oxygenated blood into the systemic circulation, delivering it to the rest of the body. This rhythmic sequence ensures a continuous flow of oxygenated blood to meet the metabolic demands of the tissues.

The heart is equipped with four vital valves that regulate blood flow and prevent backflow, ensuring unidirectional circulation. The atrioventricular (AV) valves, located between the atria and ventricles, include the tricuspid valve on the right side and the bicuspid (mitral) valve on the left. These valves open to allow blood to flow from the atria to the ventricles and close to prevent **regurgitation** (backward leakage) during ventricular contraction.

The semilunar valves (pulmonary valve on the right, aortic valve on the left) protect the exits of the ventricles. These valves open during ventricular contraction, enabling blood to be ejected into the pulmonary and systemic circulations, respectively. They then promptly close to prevent blood from regurgitating back into the ventricles during relaxation.

Understanding the dynamics of these chambers and valves is fundamental for nurses in assessing cardiac function, detecting murmurs or irregularities, and interpreting diagnostic findings found on echocardiograms and electrocardiograms. In summary, blood flowing through the heart can be described as deoxygenated blood from the body entering the right atrium which contracts to send the blood through the tricuspid valve to the right ventricle. From here, the blood must enter the lungs as it passes through the pulmonary valve. Once it is oxygenated, it returns to the left atrium of the heart where it prepares for its journey throughout the body. From the left atrium, it enters the left ventricle, passing through the bicuspid valve. From the left ventricle, it passes through the aortic valve and enters the aorta to perfuse the body. In clinical practice, nurses collaborate with healthcare team members to monitor and intervene effectively in various cardiac conditions, emphasizing the importance of maintaining the integrity of the heart's chambers and valves for optimal cardiovascular health.

Walls of the Heart

Our exploration of more in-depth heart structures begins by examining the membrane that surrounds the heart and the layers that form the wall of the heart. Each of these components plays its own unique role in terms of function.

The membrane that directly surrounds the heart and defines the pericardial cavity is called the **pericardium** (also known as the pericardial sac). It also surrounds the "roots" of the major vessels—the areas of closest proximity to the heart. The pericardium, which literally translates as "around the heart," consists of two distinct sublayers: the sturdy outer fibrous pericardium and the inner serous pericardium (Figure 24.3). The fibrous pericardium is made of tough, dense connective tissue that protects the heart and maintains its position in the thorax. The more delicate serous pericardium consists of two layers: the parietal pericardium, which is fused to the fibrous pericardium, and an inner visceral pericardium (also called the epicardium). The pericardial cavity, filled with lubricating serous fluid, lies between the epicardium and the pericardium.

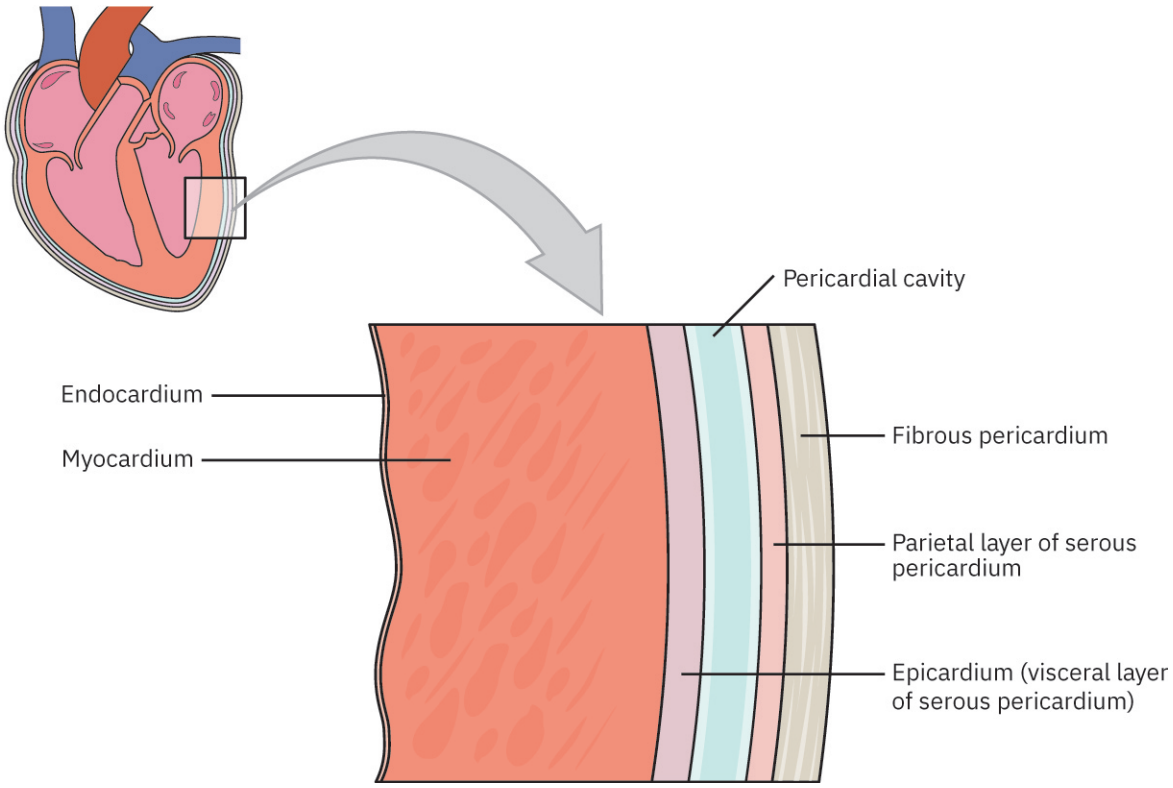

FIGURE 24.3 The pericardium that surrounds the heart consists of two layers: fibrous pericardium and serous pericardium. The heart wall consists of three layers: epicardium, myocardium, and endocardium. The pericardial cavity filled with lubricating serous fluid lies between

the pericardium and epicardium. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

The wall of the heart is composed of three layers of unequal thickness. From superficial to deep, these are the epicardium, myocardium, and endocardium. The outermost layer of the heart is the **epicardium**, which is fused to the heart and is part of the heart wall. The middle and thickest layer is the **myocardium**, made largely of cardiac muscle cells. It is built on a framework of collagenous fibers, plus the blood vessels that supply the myocardium and the nerve fibers that help regulate the heart. It is the contraction of the myocardium that pumps blood through the heart and into the major arteries. The innermost layer of the heart wall, the **endocardium**, is joined to the myocardium with a thin layer of connective tissue. The endocardium lines the chambers where the blood circulates and covers the heart valves. It is made of simple squamous epithelium called **endothelium**, which is continuous with the endothelial lining of the blood vessels.

The muscle pattern is elegant and complex, as the muscle cells swirl and spiral around the chambers of the heart (Figure 24.4). They form a figure-eight pattern around the atria and around the bases of the great vessels. Deeper ventricular muscles also form a figure eight around the two ventricles and proceed toward the apex. More superficial layers of ventricular muscle wrap around both ventricles. This complex swirling pattern allows the heart to pump blood more effectively than a simple linear pattern would.

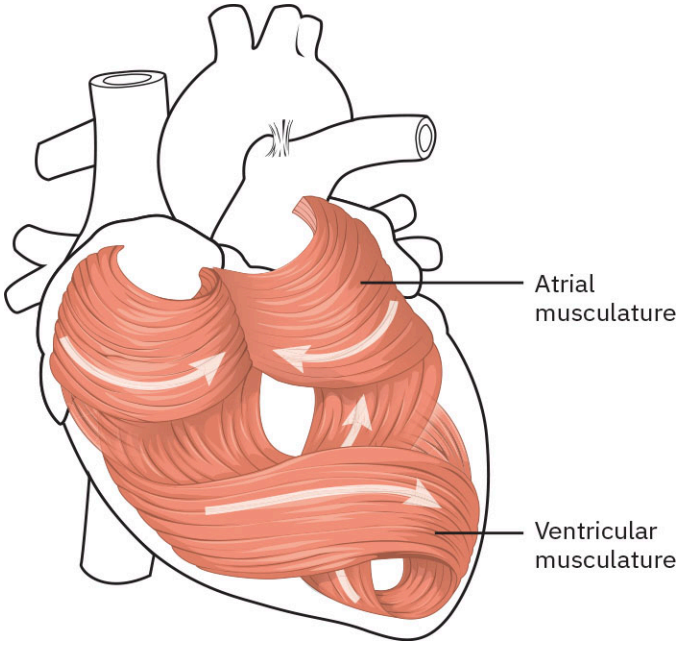

FIGURE 24.4 The swirling pattern of cardiac muscle tissue contributes significantly to the heart's ability to pump blood effectively. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Although the right and left ventricles pump the same amount of blood per contraction, the muscle of the left ventricle is much thicker and better developed than that of the right ventricle. To overcome the high resistance required to pump blood into the long systemic circuit, the left ventricle must generate a great amount of pressure. The right ventricle does not need to generate as much pressure because the pulmonary circuit is shorter and provides less resistance. As a result, the muscle in the left ventricle is thicker than in the right ventricle (Figure 24.5).

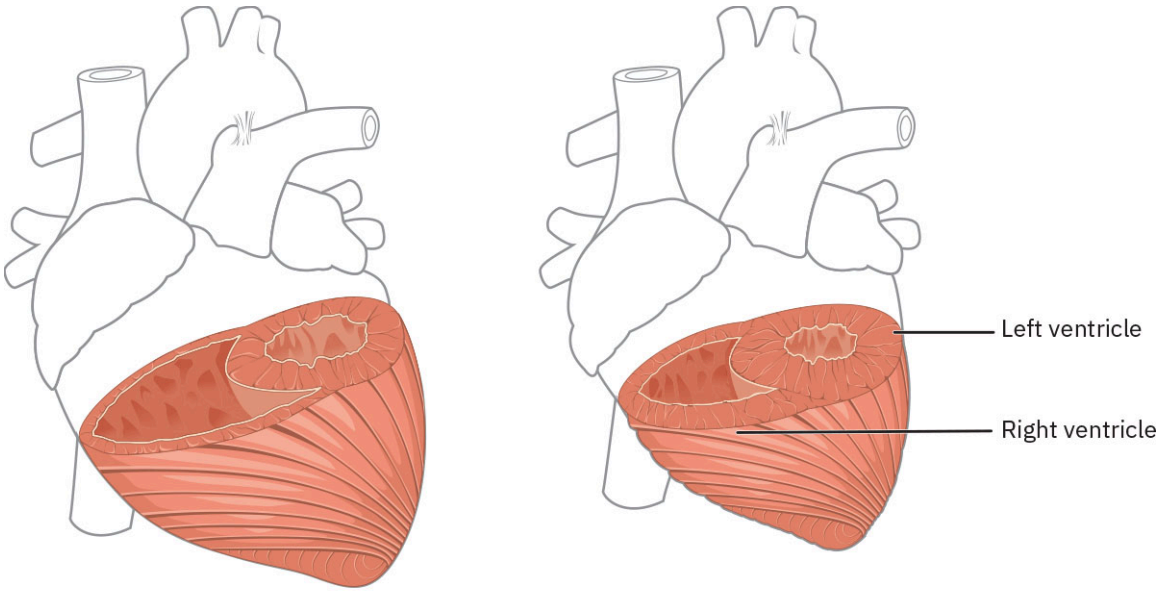

FIGURE 24.5 The myocardium in the left ventricle is significantly thicker than that of the right ventricle. The ventricles are shown in both relaxed and contracted states. Note the differences in the relative size of the lumens (the region inside each ventricle) where the blood is contained. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Blood

As you recall from anatomy and physiology, blood is a connective tissue made up of cellular elements and an extracellular matrix. The cellular elements, or **formed elements**, include red blood cells (RBCs), white blood cells (WBCs), and cell fragments called platelets. The extracellular matrix, called plasma, makes blood unique among connective tissues because it is fluid. This fluid is primarily water and continuously suspends the formed elements, enabling them to circulate throughout the body within the cardiovascular system. Fluids, whether gases or liquids, are materials that flow according to pressure gradients; they move from regions of higher pressure to regions of lower pressure.

Blood pumped by the heart flows through a series of vessels known as arteries, arterioles, capillaries, venules, and veins before returning to the heart. Arteries transport blood away from the heart and branch into smaller vessels, forming arterioles. Arterioles distribute blood to capillary beds, the sites of exchange with the body tissues. Capillaries lead back to small vessels known as venules that flow into the larger veins and eventually back to the heart.

Based on this concept, when the heart chambers are relaxed (diastole), blood flows into the atria from the veins, which are higher in pressure. As blood flows into the atria, the pressure rises, causing the blood to initially move passively from the atria into the ventricles. An action potential triggers the muscles in the atria to contract (atrial systole), causing the pressure within the atria to rise even further, pumping blood into the ventricles. During ventricular systole, pressure rises in the ventricles, pumping blood into the pulmonary trunk from the right ventricle and into the aorta from the left ventricle.

Functions of the Cardiovascular System

The primary function of the cardiovascular system is to maintain homeostasis by providing adequate blood supply to tissues. To do this, blood flow must be redirected continuously to the tissues as they become more active. There is not enough blood flow to equally distribute blood to all tissues simultaneously. Therefore, the cardiovascular system engages in a form of resource allocation to ensure active tissues are fully supplied with the oxygen and nutrients needed. For example, blood is directed to the skeletal muscles, heart, and lungs during exercise. The brain, however, receives more of a constant supply of blood whether the body is active, resting, thinking, or engaged in any other activity. Transporting blood to tissues also aids in maintaining blood pH and water balance.

To provide the body with needed oxygen, nutrients, and hormones, the cardiovascular system functions as a transportation highway. Nutrients from foods eaten are absorbed in the digestive tract where the majority travel through the bloodstream to the liver for processing. After being processed, nutritional molecules are released into the bloodstream for delivery to body cells. Transportation of oxygen occurs when inhaled oxygen diffuses into the blood from the alveoli in the lungs to the heart. Oxygenated blood is then pumped out to the body through the aorta. Hormones are released by endocrine glands that are scattered throughout the body into the bloodstream and carried to target cells. To maintain homeostasis, blood picks up cellular wastes and by-products and transports them to designated organs for removal. For example, carbon dioxide, which the blood takes back to the lungs for gas exchange, is removed from the body through exhalation.

Another function of the cardiovascular system is to defend the body against invading pathogens and damage to blood vessels caused by trauma. WBCs protect the body from external threats, such as disease-causing bacteria that have entered the bloodstream. Certain types of WBCs seek out and destroy internal threats, such as mutated cells that could lead to cancer or cells infected with a virus. When there is damage to the vessels, the body protects against blood loss by triggering platelets and thrombin to form a fibrinous barrier, typically a clot or scab depending on the location and severity of the trauma.

Thermoregulation is also an important function of the cardiovascular system and is regulated by a negative-feedback loop. This also involves resource allocation as blood is sent to the areas in need of warmth. When the body's core temperature is increased, blood is sent to the extremities, which are most often cooler. When blood moves through the vessels of the skin, heat is dissipated to the environment; therefore, blood that is returned to the body is cooler. In the same context, when the body is cooled, such as in cold weather, blood is diverted away from the skin to maintain a warmer body core. This leaves the skin of the extremities susceptible to frostbite in extreme circumstances.

Electrical Conduction of the Heart

If embryonic heart cells are separated into a Petri dish and kept alive, each is capable of generating its own electrical impulse followed by contraction. When two independently beating embryonic cardiac muscle cells are placed together, the cell with the higher inherent rate sets the pace, and the impulse spreads from the faster cell to the slower cell to trigger a contraction. As more cells are joined together, the fastest cell continues to assume control of the rate. A fully developed adult heart maintains the capability of generating its own electrical impulse, triggered by the fastest cells, as part of the cardiac conduction system. The components of the cardiac conduction system include the sinoatrial node, the atrioventricular node, the atrioventricular bundle, the atrioventricular bundle branches, and the Purkinje fibers (Figure 24.6).

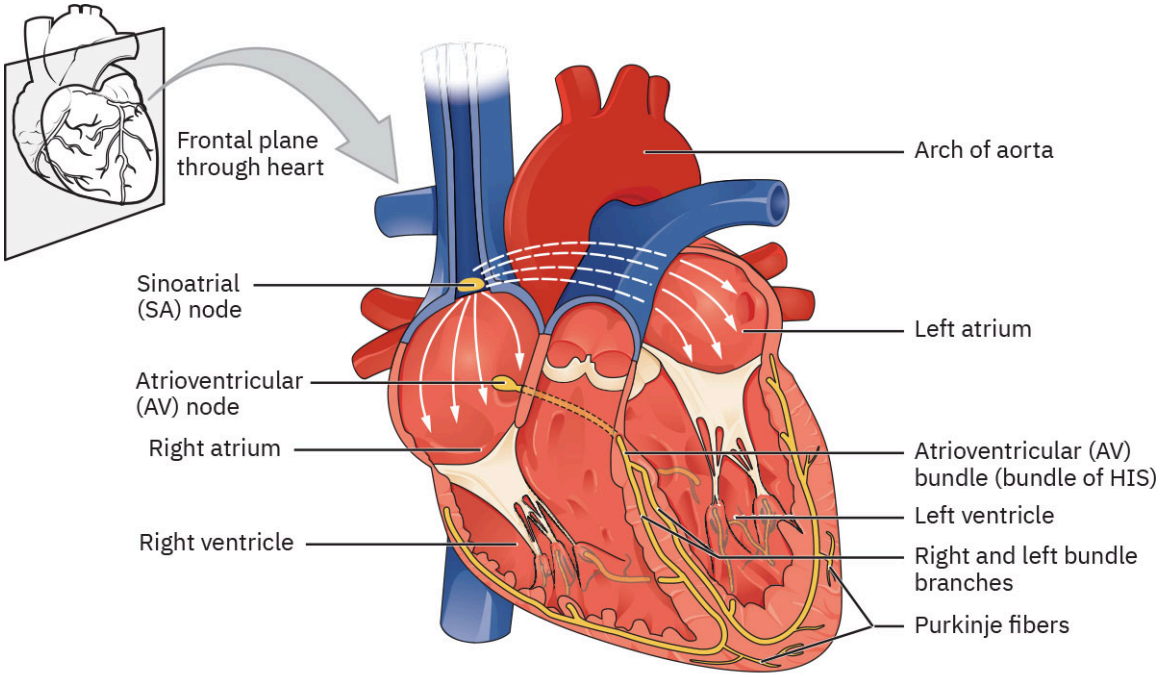

FIGURE 24.6 Specialized conduction components of the heart include the sinoatrial node, atrioventricular node, atrioventricular bundle, right and left bundle branches, and Purkinje fibers. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Pathways

Normal cardiac rhythm is established by the **sinoatrial (SA) node**, a specialized clump of myocardial conducting cells (or pacemaker cells) located in the superior and posterior walls of the right atrium near the orifice of the superior vena cava. The SA node has the highest inherent rate of depolarization and is known as the pacemaker of the heart. The SA node initiates **sinus rhythm** in which electrical stimuli are initiated in the SA node and are then conducted through the AV node, bundle of His, bundle branches, and Purkinje fibers. This normal electrical pattern is followed by contraction of the heart.

This electrical signal, called the depolarization wave, starts in the right atrium and moves across both atria. It then goes through the contractile cells, causing them to contract from the top to the bottom of the atria, effectively pushing blood into the ventricles.

The atrioventricular (AV) node, located in the lower part of the right atrium within the atrioventricular septum, is made up of special conductive cells. The septum prevents the signal from going directly to the ventricles without passing through the AV node. There is an important pause before the AV node sends the signal to the atrioventricular bundle. This pause allows the atrial cardiomyocytes to finish their contraction, pushing blood into the ventricles before the signal goes to the ventricular cells. The AV node can send signals maximally at 220 per minute with extreme stimulation by the SA node, setting the typical maximum heart rate in a healthy young person. Damaged hearts or those stimulated by drugs can beat at higher rates, but at those rates, the heart cannot pump blood effectively.

From the AV node, the atrioventricular bundle (also called the bundle of His) goes through the interventricular septum before splitting into two atrioventricular bundle branches, known as the left and right bundle branches. The left bundle branch stimulates the left ventricle, which is much larger than the right, making the left bundle branch larger too. The right bundle branch reaches the right ventricle and is connected to the moderator band and right papillary muscles. Each papillary muscle receives the signal at the same time, so they start to contract together just before the rest of the ventricular cells. Both bundle branches reach the heart's apex and connect with the Purkinje fibers, taking about 25 milliseconds (ms).

The Purkinje fibers are additional conductive fibers that spread the signal to the ventricular contractile cells. They go from the apex toward the atrioventricular septum and base of the heart. The Purkinje fibers have a fast conduction

rate, and the signal reaches all the ventricular muscle cells in about 75 ms. The signal starts at the apex, so the contraction also begins there and moves toward the base of the heart, similar to squeezing a tube of toothpaste from the bottom. This movement helps pump blood out of the ventricles and into the aorta and pulmonary trunk. The whole process, from the SA node starting the signal to the ventricles depolarizing, takes about 225 ms.

LIFE-STAGE CONTEXT

Congenital Complete Heart Block

Congenital complete heart block (CCHB) is a rare diagnosis, seen in approximately 1:15,000 to 1:20,000 live births. Diagnosis is made during fetal development and approximately 69 percent of patients have a pacemaker implanted by the first birthday. An estimated 74 percent to 96 percent of patients diagnosed with CCHB in infancy or early childhood will undergo pacemaker implantation before 20 years of age.

Dilated cardiomyopathy (left ventricular [LV] dysfunction) has been described as developing both early and late in the developmental stage with early onset caused by in utero myocardial inflammation or bradycardia. This inflammation leads to inadequate cardiac output and extreme hydrops fetalis. Late onset has been attributed to various patient characteristics (e.g., fetal diagnosis, maternal autoantibodies SSA [anti-Ro] and/or SSB [anti-La]). Left ventricular dysfunction also increases the risk for heart failure and cardiac mortality; however, previous studies have not reached a consistent consensus on the most important risk factors.

Echocardiography remains the most widely used tool to evaluate myocardial dysfunction in the pediatric population. Lifelong cardiac pacing is most often the required treatment.

Electrical Activity

Action potentials are considerably different between cardiac conductive cells and cardiac contractile cells. Although Na^+ and K^+ play essential roles, Ca^{2+} is also critical for both types of cells. Unlike skeletal muscles and neurons that have a steady, full reserve of energy that is ready to send off a signal when needed (called the resting potential), cardiac conductive cells do not have a strong or stable resting potential. Conductive cells contain a series of sodium ion channels that allow a normal and slow influx of sodium ions that causes the membrane potential to rise slowly from an initial value of −60 mV up to about −40 mV. The resulting movement of sodium ions creates **spontaneous depolarization (also, prepotential depolarization)**. At this point, calcium ion channels open and Ca^{2+} enters the cell, further depolarizing it at a more rapid rate until it reaches a value of approximately +15 mV. At this point, the calcium ion channels close and K^+ channels open, allowing outflux of K^+ and resulting in repolarization. When the membrane potential reaches approximately −60 mV, the K^+ channels close and Na^+ channels open, and the prepotential phase begins again. This phenomenon explains the auto-rhythmicity properties of cardiac muscle (Figure 24.7).

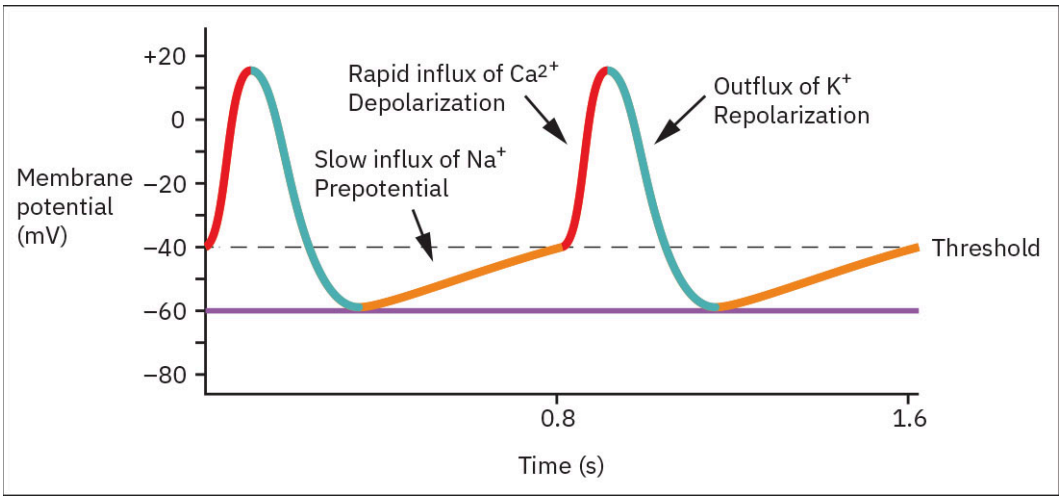

FIGURE 24.7 The prepotential phase occurs as the influx of sodium ions slowly begins until the threshold is reached followed by a rapid depolarization and repolarization. Prepotential accounts for the membrane reaching threshold and initiates spontaneous depolarization and contraction of the cell. The image helps visualize the weaker resting potential, which is what allows the buildup in the prepotential

phase. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Electrical activity in the heart's contractile cells follows a specific pattern. First, there's a quick depolarization, then a plateau phase, and finally repolarization. This process ensures that the heart muscle cells have enough time to effectively pump blood before they can contract again.

Unlike some other cells, cardiac myocytes (cells in the heart) do not start their own electrical signals. Instead, they wait for an impulse to reach them. These cells have a more stable resting phase compared to other types of cells, typically at around –80 mV for cells in the atria and –90 mV for cells in the ventricles. Despite this initial difference, the rest of their action potentials are very similar.

When these cells are stimulated by an action potential, specific channels quickly open, starting the process of depolarization. This quick influx of positively charged ions raises the cell's potential, reaching approximately +30 mV. At this point, the sodium channels close and the rapid depolarization phase lasts for about 3 to 5 ms. After depolarization, the plateau phase occurs, where the membrane potential decreases relatively slowly. This is because slow calcium channels open, letting calcium enter the cell, while only a few potassium channels are open, allowing potassium to exit. The relatively long plateau phase lasts about 175 ms.

When the membrane potential reaches approximately zero, calcium channels close, and potassium channels open again, letting potassium exit the cell. This repolarization lasts about 75 ms. The membrane potential then drops until it reaches resting levels, and the cycle repeats. This whole event takes between 250 and 300 ms.

The **absolute refractory period** for these heart muscle cells (a time when the cell cannot respond to another stimulus) is about 200 ms. The **relative refractory period**, a time when the cell can respond but needs a stronger stimulus, is about 50 ms. This extended period is crucial because the heart must contract effectively to pump blood, and this contraction must follow the electrical events. Without these longer refractory periods, the heart might contract prematurely, which would not be compatible with life (Figure 24.8).

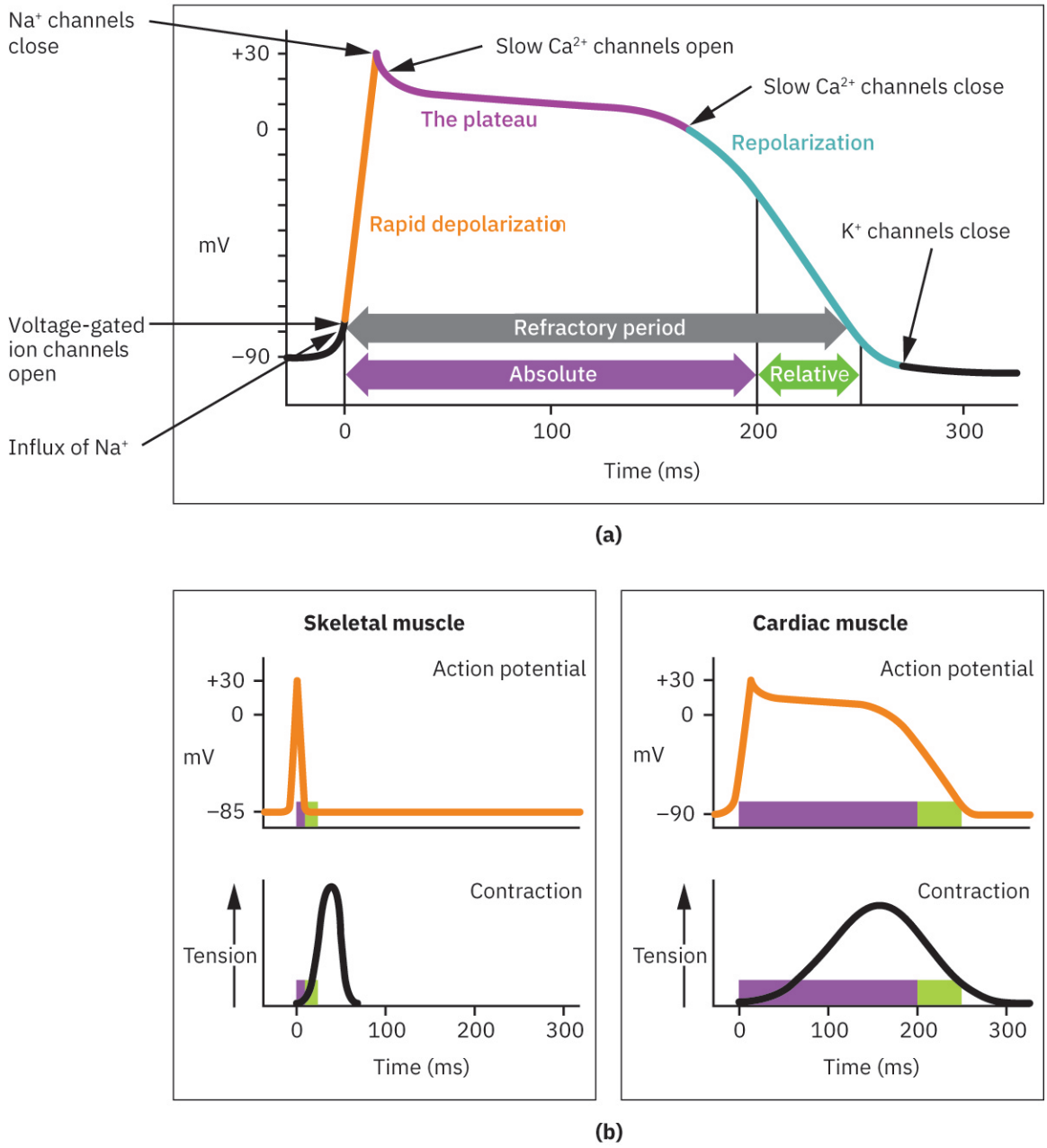

FIGURE 24.8 (a) This illustration shows the long plateau phase caused by the influx of calcium ions. The extended refractory period allows the cell to fully contract before another electrical event can occur. (b) This illustration shows the action potential of heart muscle compared to that of skeletal muscle. (credit a and b: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

There are two important roles that **calcium ion**s play in how the heart muscles work. First, calcium ions come in through special channels and help create a steady phase and a time when the heart cannot respond to signals. This helps the heart muscle work correctly. Second, calcium ions join in the troponin complex with another protein called tropomyosin. This complex removes a block that stops myosin (a type of protein) from connecting with actin, which is needed for the heart muscles to contract and pump blood. This process is quite similar to how muscles work in our body. About 20 percent of the calcium needed for the heart's contraction comes from the influx of calcium during the steady phase. The rest of the calcium comes from storage in a part of the cell called the sarcoplasmic reticulum.

The heart's pattern of prepotential, quick depolarization, and repolarization is controlled by the SA node and some other heart cells. The SA node is like the boss, and it becomes ready to send signals faster than any other part of the heart's system. It starts the signals that go to the other cells.

The SA node can send signals on its own about 80 to 100 times in a minute, even without any control from nerves or hormones. Each part of the heart system can initiate its own signals, but the rate slows down as the signal moves from the SA node to the Purkinje fibers. Without the SA node, the AV node would initiate signals at a rate of 40 to 60 times per minute. If the AV node is blocked, the atrioventricular bundle takes over and initiates signals about 30 to 40 times per minute. The bundle branches have a rate of 20 to 30 signals per minute, and the Purkinje fibers have a rate of 15 to 20 signals per minute.

Some very well-trained athletes might have a resting heart rate of 30 to 40 beats per minute. However, a heart rate lower than 60 beats per minute could mean the patient is experiencing bradycardia. When rates fall below this level, the heart might not pump enough blood to important tissues, leading to problems such as loss of function, passing out, and, eventually, death. The immediate intervention for a patient with sudden bradycardia is stabilization with respiratory and cardiovascular support, such as initiating oxygen, addressing any bleeding, and monitoring the patient with telemetry. After the patient is stabilized, the underlying cause should be addressed, and the patient's provider notified.

The Cardiac Cycle

The time during which the heart contracts and relaxes is called the cardiac cycle (Figure 24.9). When the heart pumps blood, this is called **systole** and **diastole** is when it fills with blood. Both the atria and ventricles go through systole and diastole. The body's control and coordination of these actions must be efficient in pumping blood throughout the body. In the cardiac cycle, the heart goes through atrial systole, ventricular systole, atrial diastole, and ventricular diastole, and then the cycle starts again.

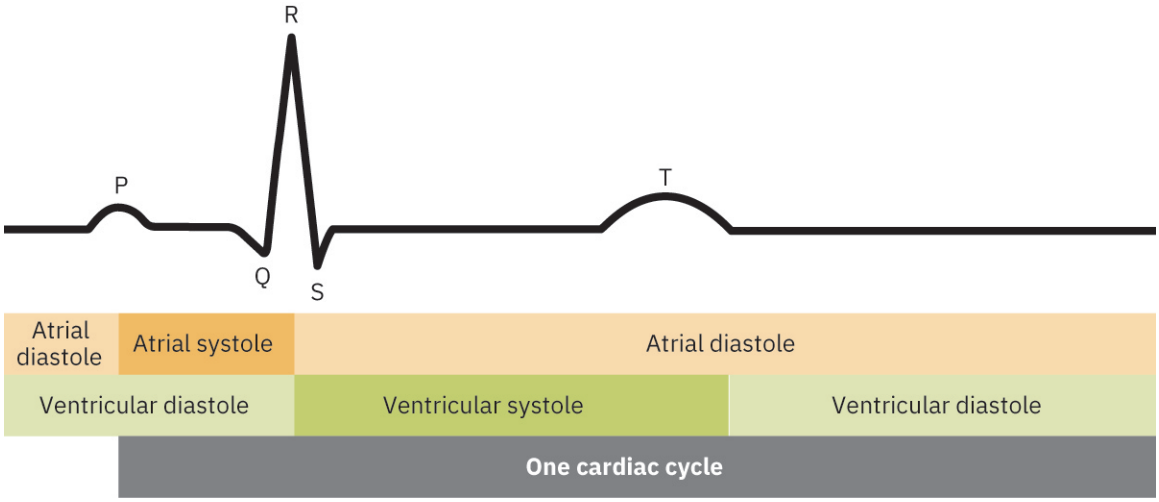

FIGURE 24.9 Initially, both the atria and ventricles are relaxed (diastole). The P wave represents depolarization of the atria and is followed by atrial contraction (systole). Atrial systole extends until the QRS complex, at which point, the atria relax. The QRS complex represents depolarization of the ventricles and is followed by ventricular contraction. The T wave represents the repolarization of the ventricles and marks the beginning of ventricular relaxation. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Fluids, such as blood, flow based on pressure differences. When the heart chambers are relaxed (diastole), blood flows into the atria from the veins, where the pressure is higher. As blood flows into the atria, the pressure rises, causing it to move passively from the atria into the ventricles. When the muscles in the atria contract (atrial systole), the pressure increases, pumping blood into the ventricles. During ventricular systole, pressure rises in the ventricles, pumping blood into the pulmonary trunk from the right ventricle and into the aorta from the left ventricle.

At the start of the cardiac cycle, both the atria and ventricles are relaxed (diastole). Blood flows into the right atrium from the superior and inferior vena cavae and the coronary sinus. Blood also flows into the left atrium from the four pulmonary veins. The atrioventricular valves (tricuspid and mitral valves) are open, allowing blood to flow from the atria into the ventricles. About 70 to 80 percent of ventricular filling occurs during this time (called preload). The semilunar valves (pulmonary and aortic valves) are closed, preventing blood from flowing back into the ventricles.

Atrial systole follows depolarization, shown by the P wave of the electrocardiogram (ECG). As the atrial muscles contract, pressure rises within the atria, and blood is pumped into the ventricles through the open atrioventricular

valves. Atrial systole lasts about 100 ms and ends before ventricular systole begins, allowing blood to flow into the atria again.

Systole

As the heart pumps, **ventricular systole** occurs and is split into two phases. First, the heart's electrical activity occurs as represented by the QRS complex. This is followed by the ventricles contracting. At this point, the blood pressure in the ventricles rises, although it is not high enough to push blood out yet. Instead, the blood flows back toward the atria, closing the valves between the atria and ventricles. At this phase, no blood has left the heart yet so volume in the heart does not change, which is referred to as **isometric contraction**.

In the second phase, **ventricular ejection**, the pressure in the ventricles is high enough to open valves by pushing blood out. This is called **isovolumetric contraction**. Ventricular ejection, which is the main measure of ventricular function, is measured as ejection fraction, the percentage of blood that the left ventricle pumps out with each contraction. Even though the left ventricle has to push against higher pressure in the aorta, both sides of the heart pump the same amount of blood. The amount of blood pumped out of the left ventricle is called **stroke volume (SV)**, or afterload. Normally, this is about 70 to 80 mL of blood. After this contraction, there's still about 50 to 60 mL of blood left in the ventricle, known as **end-systolic volume**.

Diastole

After the heart pumps, it takes a break during a phase called ventricular relaxation (diastole). This relaxation is represented by the T wave of the ECG and has two parts, lasting about 430 ms.

In the first phase, as the heart muscles relax, the pressure on the remaining blood in the heart decreases. When this pressure becomes lower than the pressure in the pulmonary trunk and aorta, blood flows back into the heart, causing a small dip in blood pressure called the **dicrotic notch** in an arterial waveform. Some valves close to prevent the blood from going back into the heart (regurgitation). The **isovolumetric relaxation** is the time interval between aortic valve closure and mitral valve opening when the ventricular pressures falls below the aortic and pulmonary pressures. During this time, cardiac circulation itself happens.

In the second phase, as the heart muscles keep relaxing, the pressure on the blood in the heart decreases even more. Eventually, it becomes lower than the pressure in the atria. When this happens, blood flows from the atria into the ventricles, opening the tricuspid and mitral valves. As the pressure decreases further, blood comes from the veins into the relaxed atria and stimulates another round of the cardiac cycle.

Cardiovascular Abnormalities That May Be Heralded by ECG Abnormalities

Occasionally, an area of the heart other than the SA node will initiate an impulse that will be followed by a premature contraction. Such an area, which may actually be a component of the conduction system or some other contractile cells, is known as an ectopic focus or ectopic pacemaker. An ectopic focus may be stimulated by localized ischemia; exposure to certain drugs, including caffeine, digitalis, or acetylcholine; elevated stimulation by both sympathetic or parasympathetic divisions of the autonomic nervous system; or a number of disease or pathological conditions. Occasional occurrences are generally transitory and nonlife threatening. However, if the condition becomes chronic, it may lead to either an **arrhythmia** (a deviation from the normal pattern of impulse conduction and contraction) or to **fibrillation** (an uncoordinated beating of the heart).

Although interpretation of an ECG is extremely valuable, a full understanding of the complexities and intricacies generally requires advanced ECG interpretation classes and several years of experience. In general, the size of the electrical variations, the duration of the events, and detailed vector analysis provide the most comprehensive picture of cardiac function. Following are some examples of ECG abnormalities and the problems these abnormalities may indicate (Table 24.1).

ECG Abnormality	Associated Condition
An amplified P wave	May indicate enlargement of the atria or hypokalemia
A P wave with decreased amplitude	May indicate hyperkalemia
Absence of the P wave or a totally irregular baseline	May indicate atrial fibrillation
An enlarged Q wave	May indicate a myocardial infarction (MI)
An enlarged suppressed or inverted Q wave	Often indicates enlarged ventricles
T waves appear flatter	May indicate that insufficient oxygen is being delivered to the myocardium
Elevation of the ST segment above baseline	Often seen in patients with an acute MI
Depression of the ST segment below the baseline	May indicate that hypoxia is occurring

TABLE 24.1 ECG Abnormalities and Their Associated Conditions

As useful as analyzing these electrical recordings may be, there are limitations. For example, not all areas of the heart suffering an MI may be obvious on the ECG. Additionally, it will not reveal the effectiveness of the pumping, which requires further testing, such as an echocardiogram or nuclear medicine imaging scan. It is also possible for there to be pulseless electrical activity, which shows an ECG tracing, although there is no corresponding pumping action. Common abnormalities that may be detected by the ECGs include second-degree block, atrial fibrillation, ventricular tachycardia, ventricular fibrillation, and third-degree block (Figure 24.10).

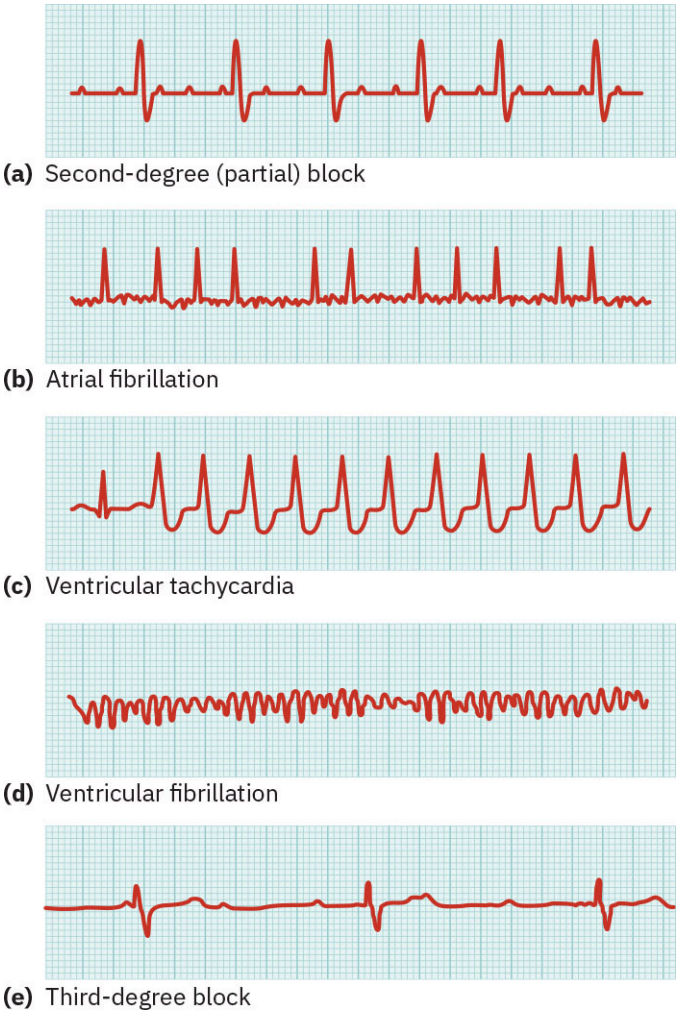

FIGURE 24.10 (a) In a second-degree or partial block, half of the P waves are not followed by the QRS complex and T waves. (b) In atrial fibrillation, the electrical pattern is abnormal before the QRS complex, and the frequency between the QRS complexes has increased. (c) In ventricular tachycardia, the shape of the QRS complex is abnormal. (d) In ventricular fibrillation, there is no normal electrical activity. (e) In third-degree block, there is no correlation between atrial activity (the P wave) and ventricular activity (the QRS complex). (credit a-e: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

24.2 Peripheral Vascular System

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the structures of the peripheral vascular system
- Explain the function of the peripheral vascular system
- Describe abnormalities in the peripheral vascular system

The peripheral vascular system plays a vital role in maintaining homeostasis—the body's effort to maintain a relatively stable equilibrium between interdependent systems, which is accomplished via the body's physiological processes. As nursing professionals, understanding the complexities of this intricate network of blood vessels is essential for providing comprehensive care to patients. The peripheral vascular system (PVS), consisting of arteries, veins, and capillaries, extends beyond the heart and encompasses the circulatory pathways that reach various tissues and organs. This system is responsible for the transportation of oxygen, nutrients, and waste products throughout the body, contributing significantly to homeostasis and overall well-being.

Nurses must have a comprehensive understanding of the peripheral vascular system. Application of the knowledge is crucial for assessing, diagnosing, and managing various health conditions. Disorders affecting this system can range from peripheral artery disease (PAD) and venous insufficiency to deep vein thrombosis (DVT) and varicose veins. By gaining insight into the anatomy, physiology, and common pathologies of the peripheral vascular system,

nurses are better equipped to identify early signs of vascular dysfunction, implement preventive measures, and provide optimal care to individuals at risk for or affected by these conditions.

The peripheral vascular system intersects with other areas of nursing care, such as wound healing, surgical interventions, and chronic disease management. Nurses play a pivotal role in promoting vascular health, offering patient education on lifestyle modifications, and collaborating with interdisciplinary teams to ensure holistic care. This exploration of the peripheral vascular system serves as a foundational guide for nursing professionals, empowering them to navigate the complexities of vascular health and contributing effectively to the well-being of their patients.

Structures of the Peripheral Vascular System

The peripheral vascular system (PVS) comprises the arteries and veins that are responsible for systemic circulation of blood throughout the body. Although the heart is the primary organ in the cardiovascular system, the peripheral vascular system ensures blood is distributed to the various tissues throughout the body, ensuring oxygen and nutrients are provided for optimal physiological function and overall health. The PVS can be described as the aorta and its branches including the arteries, arterioles, capillaries, venules, and veins.

Arteries of the PVS are conduits that transport oxygenated blood away from the heart to the tissues and organs throughout the body. Conversely, veins form an integral pathway for the return of deoxygenated blood from the body's tissues back to the heart (Figure 24.11). This intricate system, with its arterial-venous interplay, functions harmoniously to maintain the vital processes essential for the sustained well-being of the individual.

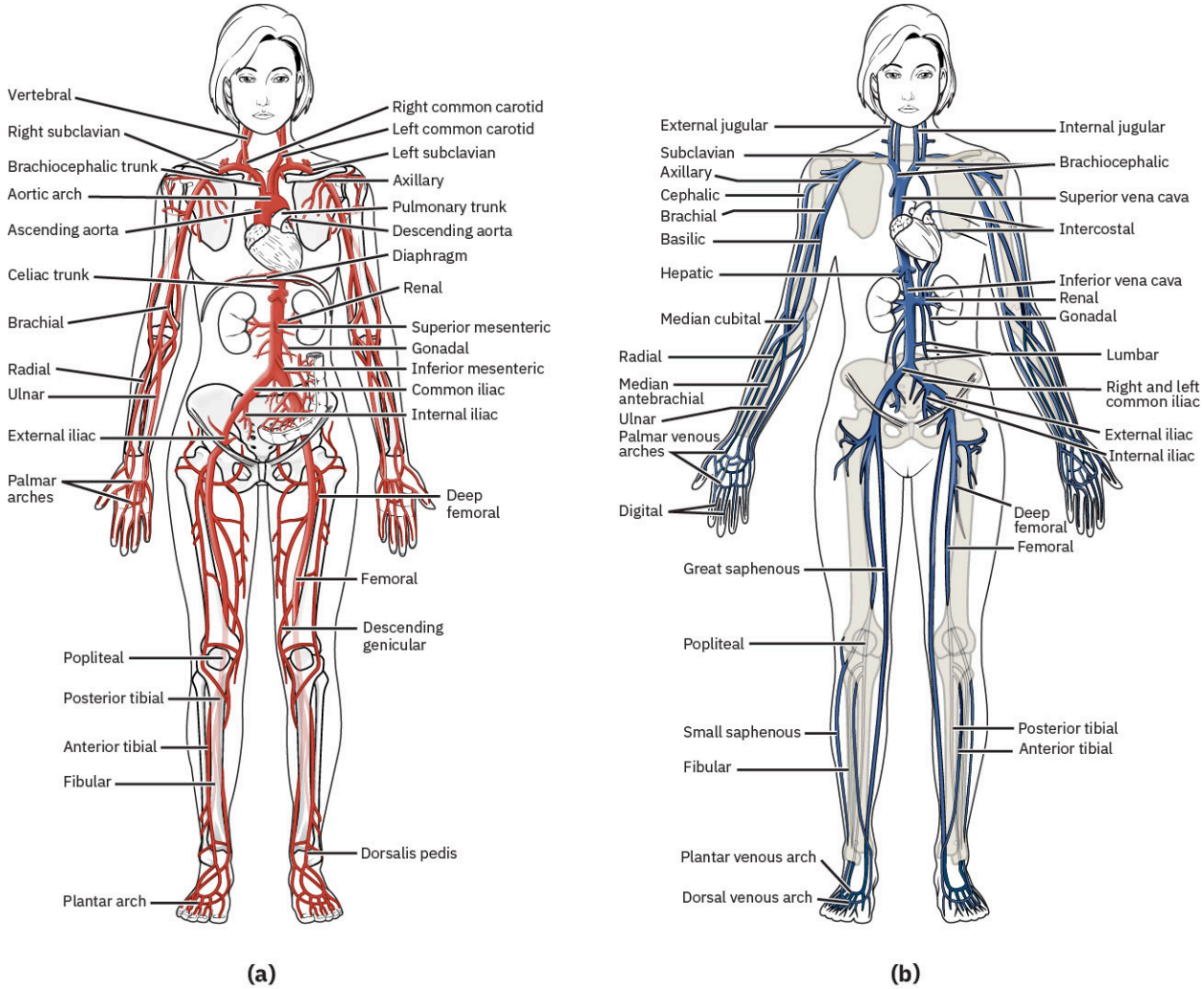

FIGURE 24.11 (a) The arterial blood flow of the peripheral vascular system supplies the body with nutrients, transporting oxygen to organs and tissues. (b) The venous blood flow of the peripheral vascular system transports deoxygenated blood back to the heart and waste for elimination. (credit a and b: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC

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Arteries

Tubelike vessels called arteries made of smooth muscles are responsible for transporting blood away from the heart via the aorta. This blood is referred to as arterial blood because it is fully oxygenated, giving it its bright red pigmented appearance. Arterial blood first and foremost delivers oxygen to the tissues in the body. The cells ultimately use the oxygen to drive cellular respiration in order to create **adenosine triphosphate (ATP)**. ATP is a nucleotide that collects chemical energy produced by the breakdown of food molecules to provide the energy necessary for all cellular activities (e.g., muscle contraction, transmitting nerve signals [nerve impulse propagation], breaking down the liquid-like substances within cells [condensate dissolution], making new molecules [chemical synthesis]). It is also involved in signal transduction pathways, DNA synthesis, and cell communication.

Arteries consist of multiple layers that are strong, elastic, and capable of dilating and recoiling as they respond to cardiac systole and diastole. As the heart contracts and pumps blood out into the vessels (systole), arteries dilate to accommodate the high pressure. Recoil then occurs as the blood is pushed through the arteries, thus creating a wave, recognized as a pulse. This relaxed phase of the cardiac cycle when the chambers of the heart are refilling with blood is called diastole.

The primary functions of the arteries are not only transportation of oxygen but also transporting nutrients and hormones throughout the body and aiding in thermoregulation. Arteries also provide oxygen and nutrients to the uterus during pregnancy, allowing for proper fetal growth. These highly adaptable vessels respond to signals and stimuli received from the central nervous system and the environment, such as temperature, chemicals, air pollution, and atmospheric pressure. A hormone neurotransmitter called **catecholamines** is released into the blood, triggering the nerves to signal the arteries to constrict or dilate based on the stimuli, thus causing a change in blood pressure. This reaction is important in maintaining homeostasis as well as optimal perfusion to tissue.

While arteries primarily carry oxygenated blood away from the heart to the body, the pulmonary artery moves deoxygenated blood from the heart to the lungs to engage in gas exchange in the alveoli. After oxygenation occurs, the arteries and veins of the pulmonary system switch roles. The pulmonary vein transports oxygenated blood back to the heart to be pushed out through the aorta to the body.

Branching from the arteries are arterioles, where blood is directed into the capillaries (Figure 24.12). These vessels have sympathetic nerve fibers that receive signals from the sympathetic nervous system, which helps to regulate the amount of blood flow to tissues. This regulation of the sympathetic nervous system triggers the arterioles to constrict, thus increasing the resistance of blood flow. When the system triggers the arterioles to dilate, the resistance is decreased. Hormones, including angiotensin II, travel through the bloodstream to act on tissues throughout the body. A **local signaling molecule**, such as prostaglandin, is released and act on a specific part of the body. Both hormones and local signaling molecules can also trigger an arteriole diameter response.

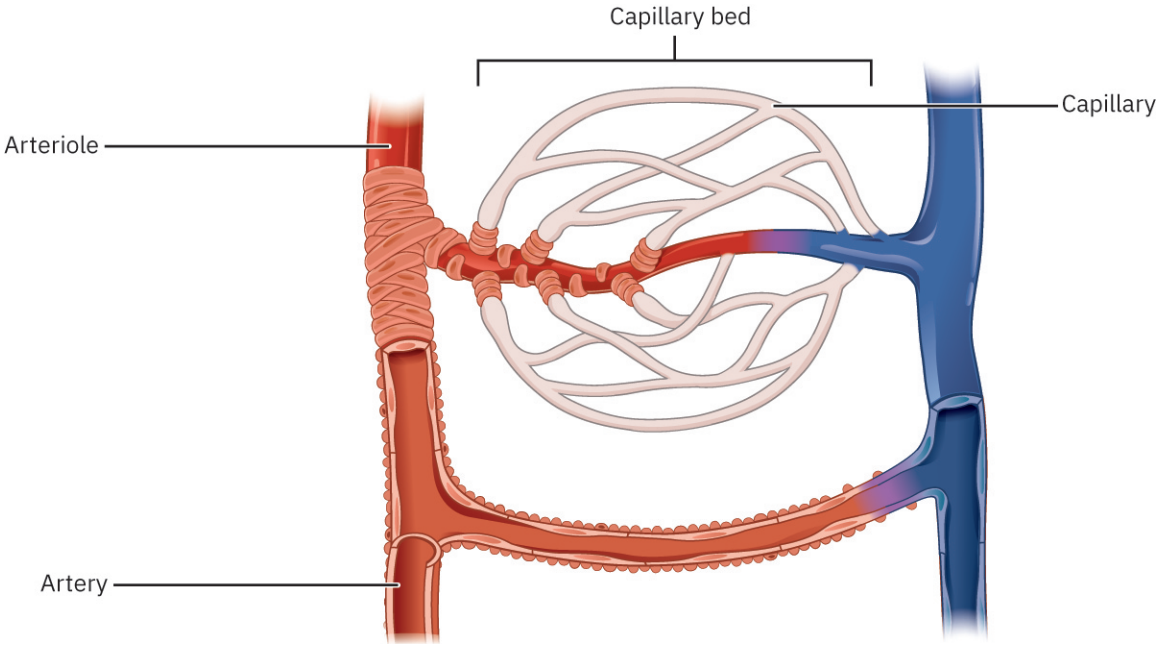


FIGURE 24.12 Arterioles are the vessels that connect the arteries with the capillaries. As blood reaches the tissue, the arteries become smaller (arterioles) so that blood can completely saturate the tissues through capillary exchange. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LIFE-STAGE CONTEXT

Arteries and Aging

During the aging process, health issues arise that often affect the cardiovascular system. Arteries stiffen and thicken, which is caused not only by advanced age, but also poor diet, sedentary lifestyle, and genetic factors. Hypercholesterolemia is a primary cause of this thickening of the arteries in the form of plaque buildup known as atherosclerosis. The arteries can also become hard or thick from other causes. The term arteriosclerosis encompasses the other reasons for the stiffening, which could include inflammation or smoking. Whatever the cause, thickening of the arteries increases strain on the heart that can lead to congestive heart failure. Continuous blockage of arteries leads to obstruction of blood to vital organs, such as the heart, resulting in ischemia, which increases the risk of myocardial infarction.

Veins

Thin-walled, low-pressured vessels, known as **vein**s, are less elastic-like than arteries. This allows for high **capacitance**, which is defined as a greater volume of blood at a much lower pressure. Venous blood is returned to the heart from the periphery by veins through skeletal muscle contraction. Unlike arteries that rely on cardiac systole to assist in the forward movement of blood, the veins are farther away from the heart and require the muscles surrounding them to contract and squeeze blood forward. Intraluminal valves located within the veins prevent blood from flowing backward, maintaining a forward flow.

Blood flow through the lower extremities relies heavily on muscle contraction to return blood to the heart. The forward movement of blood from these extremities also relies on changes in respiration that affect the pressure gradients in both the abdominal and thoracic cavities. Deep inspiration brings a higher pressure than what is observed throughout the entire respiratory cycle. This is another example of how the cardiovascular and respiratory systems work interdependently to maintain homeostasis.

When deoxygenated blood enters the capillaries, it moves through the **venules** into the veins. Like arterioles, venules are tiny vessels that transition from the capillaries into the larger return vessels that carry blood back to the heart. These vessels are small, yet highly porous, and play an integral role in gas exchange in the tissue. Working in conjunction with capillaries, the **postcapillary venule** regulates solute exchange. This is the segment of microvasculature most reactive to inflammation. Postcapillary venules contain intercellular endothelial junctions

that allow plasma proteins and circulating cells (leukocytes) to exit from the bloodstream in response to foreign agents (e.g., infection, inflammation).

Functions of the Peripheral Vascular System

The function of each segment of the PVS is dependent on the organ it supplies. The PVS plays an important role in perfusion and oxygenation of tissues of the periphery, the areas away from the center of the body. When perfusion is altered or impaired, there is risk for issues to occur such as hypoxia, tissue damage, necrosis, and even shock. Perfusion occurs as oxygenated blood from the lungs is transported to the left side of the heart and pumped out through the aorta. The oxygenated blood is then pumped to the arteries, arterioles, and into capillaries where nutrients and oxygen are exchanged. Blood that is rich in carbon dioxide, or **deoxygenated blood**, is then transported back to the heart from the capillaries, through venules, then veins into the right side of the heart via the superior and inferior vena cavae. This deoxygenated blood is then pumped through the heart to the lungs via the pulmonary artery to be exchanged in the capillaries of the alveoli with oxygen-rich blood.

Nutrients are supplied to the tissue in the same way as **oxygenated blood** that has picked up oxygen in the lungs for delivery to the body. Macromolecules such as carbohydrates, fats, and proteins along with essential vitamins and minerals are absorbed through the small intestine into the capillaries. Once in the bloodstream, nutrients are carried to various tissues by veins and venules. These vessels are smaller than arteries so nutrients are absorbed more slowly, which also allows for the exchange of waste in the capillaries. Waste is then transported in the bloodstream to the organs of elimination. For example, excess water carrying waste is transported to the kidneys and processed for elimination, whereas toxins in the blood are filtered through the liver.

Capillaries and Fluid Exchange

Capillaries are the smallest vessels where fluid is exchanged throughout the body at the cellular tissue level. It is at this point where oxygen, nutrients, hormones, waste, and other molecules are exchanged. Smaller molecules (e.g., gases, lipids) can diffuse directly through endothelial cells of the capillary wall. Larger molecules (e.g., glucose, sodium, potassium, calcium) use transporters to move through the membrane by facilitated diffusion. Water moves across the membrane through osmosis. The thickness of the artery and arteriole walls limits premature exchange of oxygen-rich blood and nutrients, allowing for optimal perfusion at the tissue level. Capillaries are classified by their function as well as structure and arrangement of endothelial cells and basement membrane. This allows for the exchange of molecules needed for specific tissue function (Figure 24.13).

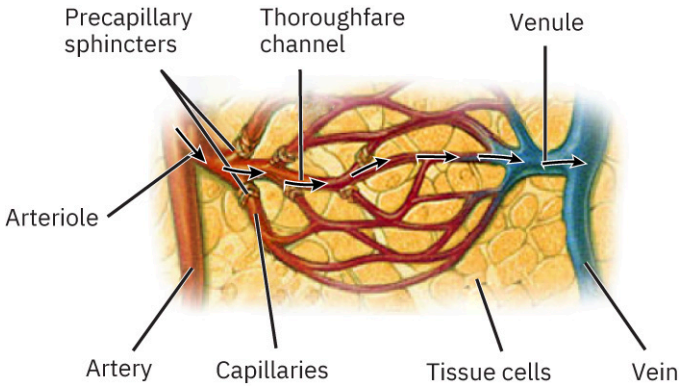


FIGURE 24.13 Loading and unloading of nutrients occur within the capillaries that are attached directly to tissues. Exchange of oxygenated and deoxygenated blood occurs at this level to maintain homeostasis. (credit: modification of work from *Biology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Common in muscle, connective, and nervous tissues are **continuous capillaries** and they have the lowest permeability capabilities of all capillaries. Molecules needed for function (e.g., water, glucose, hormones, gases) can pass through these capillaries, but large molecules (e.g., plasma proteins, platelets) are blocked. Continuous capillaries create the **blood-brain barrier** that prevents toxins from entering into the tissues of the brain. The brain, however, does need rapid absorption and filtration of vital nutrients, water, and glucose, which is provided through continuous capillaries that have small pores in them. These are called **fenestrated capillaries**, and they are located in areas that require rapid absorption or filtration (e.g., kidneys, small intestines, brain). These capillaries have many fenestrae, which are like windows or pores, and provide no resistance to fluid flow across the membranes. Found in

areas where white blood cells are formed are **sinusoid capillaries** and they have large pores that are required to allow for movement of these cells in and out of the bloodstream. These capillaries can be found in areas such as red bone marrow and the liver. Red bone marrow produces red and white blood cells and platelets. On the other hand, yellow bone marrow produces fat, cartilage, and bone.

When material is transferred between capillary blood and body tissues, this is **capillary exchange**, which is essential for delivery of nutrients and removal of waste products. Fluid exchange in the capillaries occurs through opposing forces called hydrostatic and osmotic pressures. The pressure of fluids against the walls of the capillaries that forces molecules, typically water, through the capillary wall is called **hydrostatic pressure**. While osmotic pressure is the minimal pressure of a solution needed to stop the movement of a solute across a semipermeable membrane. Osmotic pressure works to prevent the movement of water across a semipermeable membrane to maintain homeostasis between intracellular and extracellular fluid. It is important to note that in this process, solutes cannot pass through the capillaries, only the solvent (e.g., water) (Figure 24.14).

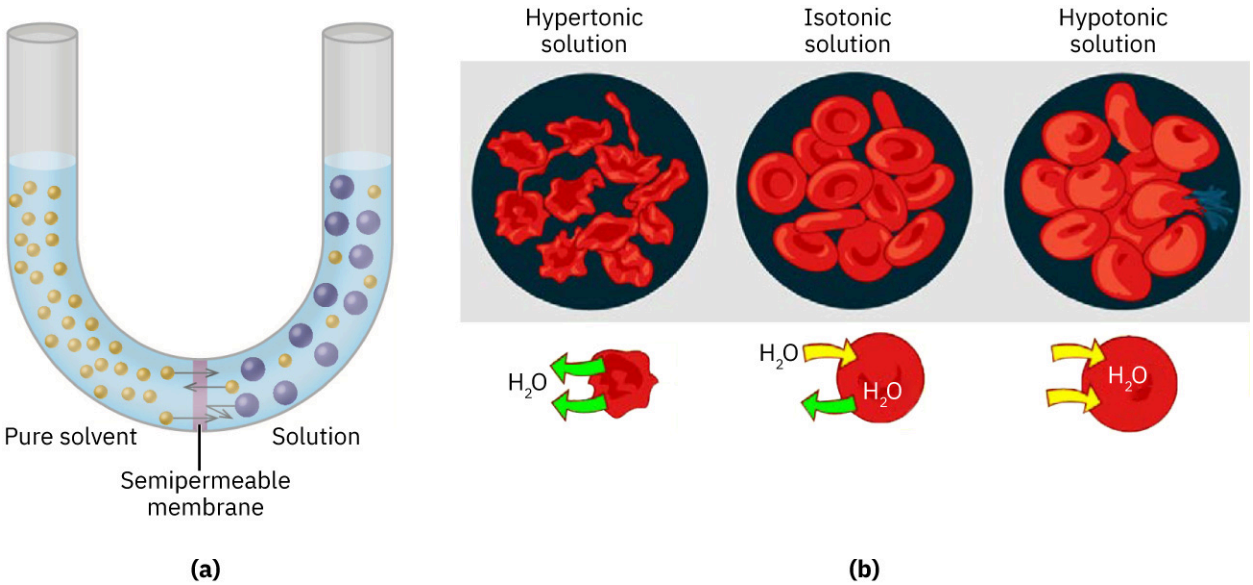


FIGURE 24.14 (a) Osmosis occurs when the solution becomes heavy with solvent or solute, causing an imbalance in the tonicity of the solution, which causes a buildup of pressure and forces the solvent to move through the semipermeable membrane. (b) The tonicity of a solution determines whether the solvent moves in or out of the cell. Isotonic solutions have equal amounts of solutes and solvent so no movement occurs; hypertonic solutions have more solutes outside the cell, causing water to move out of the cell to balance the solution and hypotonic solutions have lower solutes in the cell, causing water to move inside the cell to maintain balance. (credit a and b: modification of work from *Chemistry*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Capillary exchange occurs through one of three mechanisms: diffusion, **transcytosis**, and bulk flow. Diffusion depends on a difference in the gradient between the blood and interstitial tissue to allow the flow of small molecules across the capillary wall. Molecules, such as glucose and oxygen, are moved from the bloodstream into the tissue, and waste products, such as carbon dioxide, move from the tissue into the bloodstream. This is the most widely used mechanism within the body that allows movement of molecules from areas of high concentration to areas of low concentration.

Transcytosis allows for larger, lipid-insoluble substances to cross the capillary membrane through processes called **endocytosis** and **exocytosis**. Endocytosis brings molecules into the cell, allowing for nutrient absorption and hormone regulation as well as maintaining fluid balance. Exocytosis is the process of moving molecules out of the cell to be eliminated or moved to another area of the body.

Net filtration pressure to modulate capillary dynamics using small, lipid-insoluble solutes in water to cross the capillary wall is called bulk flow. Movement across the wall is bidirectional based on hydrostatic or osmotic pressure (Figure 24.15). Osmotic pressure (also called oncotic or colloid osmotic pressure) is exerted by proteins, and hydrostatic pressure is generated by the pressure of fluid within or outside the capillary on the capillary wall. Net filtration pressure, the sum of forces, determines the fluid flow in or out of the capillary. Larger plasma proteins (e.g., albumin) cannot cross easily through the capillary walls, resulting in fluid leakage from the capillaries. However, when there is decreased volume of plasma proteins, or blood pressure is increased significantly, there is a change in

net filtration, causing excess fluid buildup in the tissues (edema).

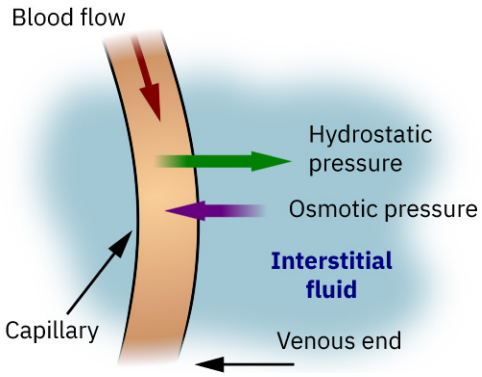


FIGURE 24.15 Capillary microcirculation involves hydrostatic and osmotic pressures that move molecules across the capillary wall. (credit: modification of work "Capillary microcirculation.svg" by "Kes47"/Wikimedia Commons, Public Domain)

Abnormalities in the Peripheral Vascular System

Common disorders of the peripheral vascular system (PVS) include peripheral artery disease (PAD) and peripheral vascular disease (PVD). Typically, abnormalities that occur in the PVS are occlusive or functional in nature, both of which involve blockage or narrowing of the blood vessels in the periphery (Figure 24.16).

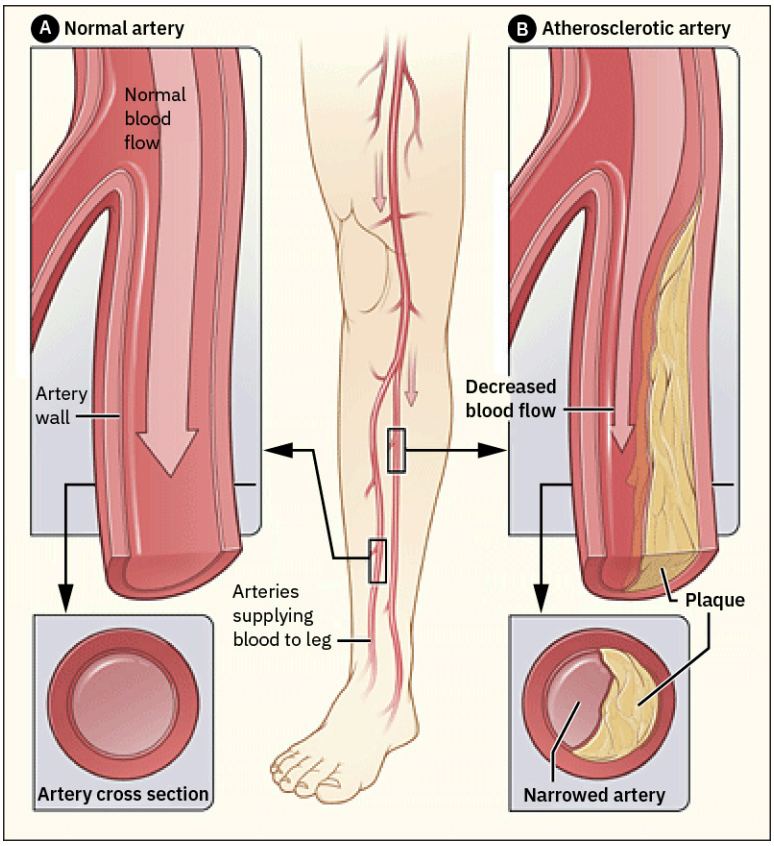


FIGURE 24.16 Both peripheral artery disease (PAD) and peripheral vascular disease (PVD) involve narrowing of the peripheral blood vessels typically caused by a buildup of plaque. (credit: modification of work "Peripheral Arterial Disease.gif" by National Heart Lung and Blood Institute/Wikimedia Commons; Public Domain)

An obstructive or organic blockage, called an **occlusive blockage**, involves inflammation, plaque buildup, or trauma to tissue. A **functional blockage** involves changes in the vessels as a result of temperature, blood pressure, and various nervous system signals. These changes cause dilation (widening) or constriction (narrowing). Some abnormalities are cosmetic (e.g., varicose veins) but others are more severe and can lead to crisis (e.g., deep vein thrombosis (DVT)) (Table 24.2).

Occlusive Disorders of the PVS		
Condition	**Description**	**Risk**
Atherosclerosis	Thickening or hardening of the arteries over time	• Potential heart attack or stroke
Buerger disease (thromboangiitis obliterans)	Chronic inflammatory condition that blocks blood flow in the minor arteries of the extremities; Almost all people who get Buerger disease smoke cigarettes or use other forms of tobacco (e.g., chewing tobacco)	• Blood clots and blockages typically experienced in the feet first and eventually the hands • Infection and death of body tissue (gangrene) • Amputation of fingers and toes if patient does not stop all forms of tobacco consumption
Carotid artery disease	Narrowing of the carotid artery that impairs oxygenation to the brain	• Stroke
Deep vein thrombosis (DVT)	Blood clots that develop in a vein within a muscle (deep vein); typically, after long periods of inactivity	• Pulmonary embolism (blockage of the lung artery) if the clot dislodges and travels to the lungs
Lymphedema	Swelling caused by buildup of lymph (fluid in the lymphatic system that travels through the body to fight disease and infection) *Note: There is a higher incidence of lymphedema in people who have had or are undergoing cancer treatment, (e.g., surgery, radiation therapy)	• Problems moving the affected limb • Skin changes and breakdown • Increased risk of skin infections and sepsis
Functional Disorders of the PVS		
Condition	**Description**	**Risk**
Chronic venous insufficiency (CVI)	Dysfunction of the valves in the veins that prevent the return of blood from the legs to the heart	• Pooling of blood in the legs • Leg pain and swelling • Leg ulcers

TABLE 24.2 Occlusive and Functional Disorders of the Peripheral Vascular System

Raynaud phenomenon	Decreased blood flow to the fingers (and sometimes ears, toes, and nose) brought on by cold temperatures and stress or anxiety	• Minimal • Cold fingers • Pain is usually not experienced
Varicose veins	Enlarged, twisted, visible, often blue veins caused by venous insufficiency; typically occur in the legs as a result of pregnancy, obesity, and extended periods of standing	• Cosmetic discoloration of the skin • Slight pain in some cases

TABLE 24.2 Occlusive and Functional Disorders of the Peripheral Vascular System

Characteristics of Arterial and Venous Insufficiency

Patients experience an insufficient supply of blood throughout the body when narrowing of the arteries and veins occurs, which is caused by systemic atherosclerosis. The most affected areas are the lower extremities because of their distance from the heart. A primary symptom of peripheral vascular disease is **intermittent claudication**, a cramp-like muscle pain, burning sensation, or extreme fatigue in the calf, thigh, or buttocks that is induced by exercise and relieved by rest. Acute or critical limb ischemia may occur if left untreated.

PATIENT CONVERSATIONS

What If Your Patient Complains About Leg Pain?

Scenario: An 80-year-old female presents to the primary care provider's office with complaints of new onset leg pain. The nurse begins to ask the patient questions before beginning a physical assessment.

Nurse: Hi, my name is Rachel, and I am going to be your nurse today. Do you mind verifying your name and date of birth for me?

Patient: I'm Elizabeth Johansen and my birthday is March 26, 1944.

Nurse: Can you tell me why you came to see us today?

Patient: I've been taking my dog for a walk three times a day for literally ten years. Probably a couple of months ago I started to notice that after walking a little bit, my calf starts hurting. It gets bad enough that I have to sit down till it goes away.

Nurse: Show me where it hurts and tell me what the pain is like.

Patient: The worst of the pain is right here [Patient points to her right calf]. At first, my right leg just feels real tired but then I get like a charley horse in my calf and it starts to burn.

Nurse: Does this happen to your left leg?

Patient: No, just my right leg. But it goes away after I rest a bit. That's why I waited to come in. I thought it would just go completely away. But it isn't—in fact I think it might be getting worse.

Nurse: Do you have a current or past history of smoking?

Patient: No, not ever.

Nurse: That's good because some vascular conditions are caused or made worse if you smoke. I see that your weight is good for your height and your blood pressure was good this morning. According to your medical record, you're not taking any medicine for diabetes, high blood pressure, or high cholesterol. Is that correct?

Patient: Yes, I may be old [Patient laughs] but I am actually in good health.

Nurse: Yes, I can see that and you have a great sense of humor too! May I examine your legs? [Patient nods yes] I feel the pulses in your left foot very well but the pulses in your right foot seem less in comparison. And your right foot feels a little cooler.

Patient: Is that bad?

Nurse: Not necessarily but it does indicate that something is going on. It could be intermittent claudication, which is pain caused by too little blood flow to muscles during exercise, such as walking. Intermittent means the pain usually isn't constant; it begins during exercise and ends with rest.

Patient: That sounds exactly what I've been feeling. Can it be fixed?

Nurse: Yes, but first we need you to see your doctor and probably get some tests down. Do you have time to wait a bit while I have the doctor come in to talk to you?

Patient: Yes, I do. That's great; I'd hate to have to wait weeks to figure this all out.

Nurse: Good. Do you need a magazine to read while you wait or a bottle of water?

Patient: No, I always carry a book with me and I have a bottle of water right here in my purse so I'm good for now.

Nurse: Okay, the doctor should be in to see you soon.

Vascular insufficiency in the extremities manifests as delayed venous filling time, cool skin, and abnormal skin color. An abnormal pedal pulse may be palpated and femoral artery bruit may be heard on auscultation. Findings may be subtle or there may be no symptoms, making diagnosis difficult. Diagnostic testing is critical in determining proper treatment. The ankle-brachial index (ABI) is the most common test used for patients in the outpatient setting. Blood pressure from the brachial artery in the arm is taken and compared with blood pressure from the posterior tibial and dorsalis pedis arteries in the ankle (Figure 24.17). Accurate results of the ABI depend on the provider's ability to perform the test correctly.

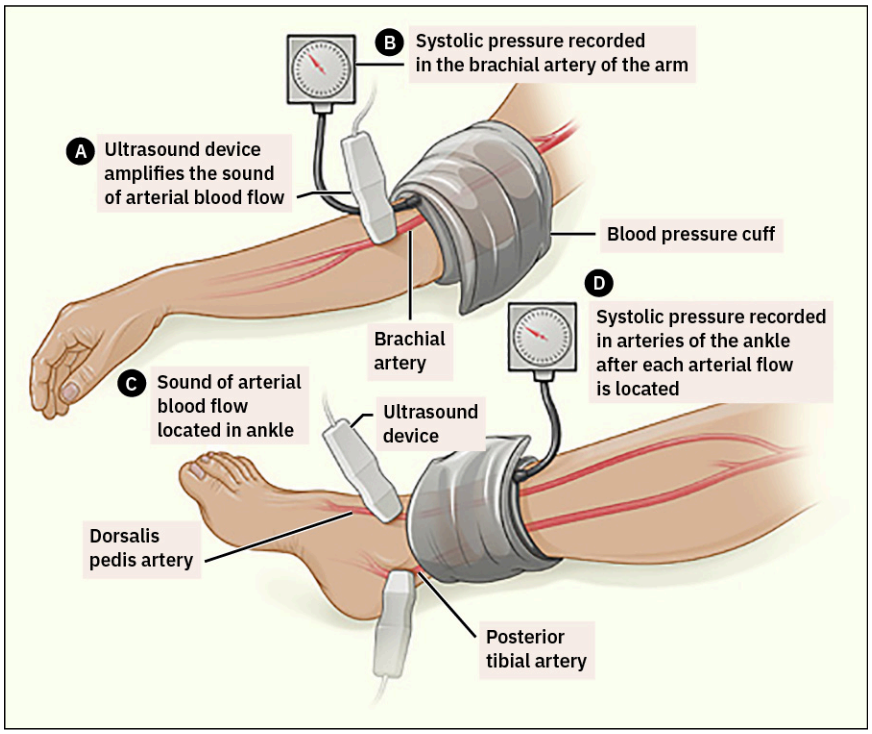


FIGURE 24.17 The ankle-brachial index (ABI) test is used to determine blood flow to the heart. (credit: modification of work "Pad abi.jpg" by National Heart Lung and Blood by (NIH)/Wikimedia Commons; Public Domain)

Both venous and arterial insufficiencies are the result of systemic atherosclerosis, but in different types of vessels. Blockage in the veins between the extremities and heart is **venous insufficiency** and can result in thick, tough skin that is brownish in color Figure 24.18).

FIGURE 24.18 Venous insufficiency is a decrease in blood flow back to the heart from the legs. The skin of the lower leg will be thick and brownish in color. (credit: modification of work "Venoplasty and Venous Stenting in Patients with Chronic Venous Insufficiency in the Lower Extremities" by National Library of Medicine, CC BY 3.0)

In contrast, **arterial insufficiency** is blockage in the arteries, limiting blood flow to the extremities and resulting in thin, shiny, dry skin that is cool to the touch.

LINK TO LEARNING

Home healthcare patients are at a higher risk for developing peripheral vascular disease (https://openstax.org/r/77PVDRisk) because of age and chronic health conditions that inhibit or limit activities. Increased incidences of obesity, diabetes, and heart conditions are additional contributing factors that are addressed in the nursing care plan.

Edema

Edema is the collection of excess tissue fluid in the interstitial space outside of the cell that results in swelling. This occurs most often in the lower extremities throughout the day caused by gravitational pull and is seen in people who stand or sit for long periods of time (e.g., long-distance airplane flights and car trips). The problem is immobility secondary to the lack of muscle contractions. However, **clinical edema** is the accumulation of fluids that is in excess of normal daily occurrences and requires medical intervention. Table 24.3 describes the various types of edema.

Type of Edema	Description
Peripheral edema	Swelling of the feet, ankles, legs, hands, and arms
Pulmonary edema	Collection of excess fluid in the lungs, making breathing difficult

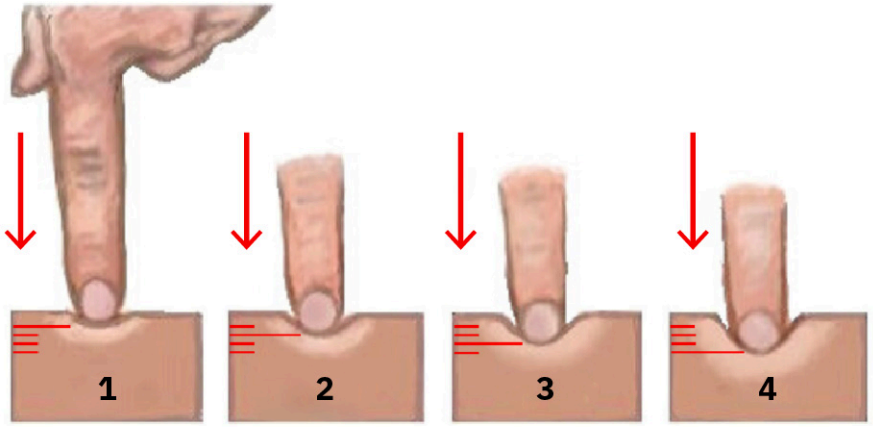
TABLE 24.3 Types of Edema

Type of Edema	Description
Cerebral edema	Excess accumulation of water in the intracellular and/or extracellular spaces of the brain
Macular edema	Swelling of the macula (part of the retina) caused by fluid leakage and accumulation; a serious complication of diabetic retinopathy
Periorbital edema	Swelling around the eyes, most often temporary

TABLE 24.3 Types of Edema

Venous blood is forced toward the heart by the skeletal muscle pump or muscle contractions, which include one-way valves to prevent blood from backing up in the vessels. A lack of use of these muscles and pumps, or dysfunction in the cardiovascular system, contributes to lower extremity edema. Often, this is a result of patients being non ambulatory or relying primarily on a wheelchair. Blood flow to the legs becomes congested because of increased hydrostatic pressure caused by decreased function.

An early indicator of venous dysfunction is dependent edema, which is measured by placing slight pressure with a finger in the area of swelling to determine the degree of pitting. A **pitting edema** is rated based on the depth of indentation and the time it takes to recover. This rating is on a scale of 0 (absent, no clinical findings) to 4+ (very deep pit that lasts up to two to five minutes) (Figure 24.19) (Swenty & Hall, 2020).



Grade 1	Grade 2	Grade 3	Grade 4
0–2 mm indentation	3–4 mm indentation	5–6 mm indentation	8 mm indentation
Rebounds immediately	Rebounds in < 15 seconds	Rebound may last more than 1 minute	Rebound may last longer than 2 minutes

FIGURE 24.19 Edema is measured by placing slight pressure on the area of swelling, releasing, and then determining the lapse in recovery. (credit: modification of work "Grading of Edema" by Chippewa Valley Technical College; CC BY 4.0)

Heart failure, liver disease, pregnancy, dietary intake, kidney disease, and some medications all contribute to the onset of edema as well as the severity of the condition. It is important to understand that edema is not a discrete disorder but a sign of an underlying disorder that must be addressed. Although edema can occur in any area of the body, the lower extremities are most often affected in peripheral vascular disease. Heart failure, hypertension, and deep vein thrombosis (DVT) are all disorders that must be accurately diagnosed to properly treat and alleviate edema.

Hypoalbuminemia contributes to the reduced oncotic pressure that manifests as hair loss in some chronic illnesses such as nephrotic syndrome, lupus nephropathy, and chronic glomerulonephritis. Cirrhosis and chronic liver disease (e.g., hepatitis C, alcohol abuse) also contribute to inadequate albumin absorption leading to edema. When swelling is unilateral, or asymmetrical, the cause is most often due to venous thrombosis. Accurate assessment and testing

is needed to determine the exact location of edema and create a comprehensive nursing care plan. Cardiomyopathies that produce equal involvement of both left and right ventricles will manifest as both pulmonary and peripheral edema. However, right-sided heart failure (also called cor pulmonale) will manifest with edema in the extremities (Lent-Schochet & Jialal, 2023).

Signs of edema are determined by the underlying contributing factor but most often begin with swelling of the ankles. Swelling that begins to rise into the legs should warrant a thorough assessment. Signs and symptoms that may accompany swelling include shortness of breath and pitting edema.

REAL RN STORIES

Frequent Hospital Visitors

Nurse: Natasha, BSN
Clinical setting: Preoperative area of a busy operating room
Years in practice: 7
Facility location: A suburb of a large metropolitan area in Colorado

We serve a diverse, lower-to-middle class, large retirement-age population. I was working the 7 a.m. to 3:30 p.m. shift. One of my patients arrived with her husband and adult daughter around 9:15 a.m. in preparation for corneal transplant surgery early that afternoon.

After having the patient change into a hospital gown and slippers, I took vital signs including weight (171 lbs. [78 kg]), height (5′ 2″ [157 cm]), and pain level (3/10). I completed the ophthalmic portion of the assessment, and then began to perform the rest of the admission assessment. I noted that the patient had lower extremity edema and swelling that encompassed both feet and rose to the midcalf. I noted that it was pitting edema and I rated it as moderate, with pitting approximately 5 mm in depth that took almost thirty seconds to resolve.

I realized that edema is not a discrete disorder—it's a sign of an underlying condition. So, I needed to get more information from the patient to determine the cause. First, I asked the patient about the edema—how long ago it started, does anything help it (such as elevation), does anything make it worse (such as sitting with feet dependent on the floor), whether she had any unexplained abdominal fullness or sudden weight gain, or any shortness of breath.

I also looked at the patient's medical record and noted that she was a smoker, had high blood pressure, and that her mother had died of congestive heart failure. So, based on her history and the assessment, I was concerned that the edema was a sign of heart failure. I documented my findings in her chart and notified the surgeon.

Pain and Cramping

Symptoms of peripheral vascular disease (PVD) depend on the affected artery and the severity of blood flow restriction. A condition in which oxygen-rich blood flow is restricted or reduced in a part of the body is called ischemia. Indications of PVD can include pain and cramping that is dull, numbing, or tingling. Intermittent claudication is pain in the calves, thighs, and buttocks that occurs when walking distances and is relieved with rest. However, as the disease progresses, pain occurs when walking shorter distances and can cause a limp. Over time, the pain may become severe, prohibiting walking completely. While most often experienced in the calves and upper legs, the feet and hips may be affected as well. Intermittent claudication is most often experienced in men older than age 55 and women aged 60 and older (Lent-Schochet & Jialal, 2023).

During a peripheral vascular assessment, it is important to ask if pain is intermittent, relieved with rest, or continuous. Asking these questions can help determine the potential for secondary conditions, which can manifest as leg pain on exertion but is relieved when at rest, or exertional leg pain that continues on, even when at rest. The location of pain along with how the patient describes the quality of pain can also indicate the site of potential ischemia:

- Thigh: common femoral, aortoiliac
- Upper calf: superficial femoral
- Lower calf: popliteal

- Buttock, hip: aortoiliac
- Foot: tibial, peroneal
- Genitalia: aortoiliac-pudendal

Based on the patient's description and location of the pain, the nurse should notify the provider and then provide pain relief measures and continue to monitor for tissue perfusion. Other interventions may include observing for deep vein thrombosis (DVT), assessing popliteal and pedal pulses, assisting with position changes, and administering anticoagulants and pain medication as ordered. Nurses also should provide patient and family education to include instructions on how to safely apply warmth to the area, encourage range-of-motion (ROM) exercises, exercise therapy, and ambulation as tolerated. It is also important to provide education to the patient on at-home care, which should include dietary recommendations.

Temperature Changes

The temperature of the skin is affected by insufficient blood flow to and from the tissues. Interrupted blood flow to the tissue results in arterial insufficiency, and interrupted blood flow away from the tissue is venous insufficiency. Chronic, or advanced, insufficiency can result in damage to the tissue of the extremities, including ulceration and gangrene. Skin that is cold and clammy, especially over the lower legs, is attributed with arterial insufficiency. Skin that is warm with edema around the ankles are attributed to venous insufficiency (Table 24.4).

Arterial Ulcers	Venous Ulcers
Intermittent claudication pain	Dull, achy pain
No edema	Lower leg edema
No pulse or weakened pulse	Pulse present
No drainage	Drainage
Round, smooth sores	Sores with irregular borders
Black eschar	Yellow slough or ruddy skin
Sores on feet or toes	Sores on ankles

TABLE 24.4 Arterial versus Venous Ulcers The differences in arterial and venous insufficiency can be recognized by the type of pain and edema present, ability to palpate pulses, and the location of sores. For example, arterial insufficiency will have intermittent claudication pain, no edema, and sores on the toes and feet; venous insufficiency will have pain that is described as dull and achy, lower leg edema, and sores located on the ankles.

Skin Changes

Just as there are changes in skin temperature with blood flow insufficiency, there are skin changes as well. Skin on the lower legs that appears thin and shiny with hair loss is attributed to arterial insufficiency. Skin also may be pale on elevation and reddened on dependency. Nails appear thickened and ridged. Ulcerations can occur at points of trauma on the toes or feet. In contrast, skin around the ankles that appears thickened and brown is attributed to venous insufficiency. Skin may be cyanotic on dependency with petechiae occurring prior to brown pigmentation. Stasis dermatitis, also called venous eczema, may also be seen around the ankles. If ulcerations occur, they are typically found over the medial side of the ankle (Patel & Surowiec, 2023).

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Assessment of Support System

Patient-centered care: Recognize the patient or designee as the source of control and full partner in providing

compassionate and coordinated care based on respect for patient's preferences, values, and needs.

Competency: Examine common barriers to active involvement of patients in their own healthcare process.

Exemplar: Patient A is an inpatient receiving wound care related to peripheral artery disease (PAD). The patient lives alone and has not been adhering to recommendations for diet, smoking cessation, and compression stockings. When asked, the patient states the closest family member is a daughter who lives about two hours away.

Solution: Ensure patient is supported at home, has transportation to and from appointments, and fully understands what is being requested of them.

24.3 Nursing Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe how to collect subjective data when performing cardiovascular and peripheral vascular assessments
- Explain how to collect objective data when performing cardiovascular and peripheral vascular assessments
- Discuss how to identify abnormalities identified during cardiovascular and peripheral vascular assessments

The initial assessment performed by the nurse is instrumental in the care of a patient and provides vital information for the provider and collaborative healthcare team. Data collected during the assessment allow the nurse to make critical decisions about short- and long-term care and address immediate emergencies as needed. When assessing a patient's cardiovascular and peripheral vascular systems, having a full understanding of the components of both systems is important in determining how information provided by the patient provides signs of dysfunction.

Subjective data that come from the patient include information such as pain, nausea, and experiences that cannot be seen or measured. In comparison, objective data collected include empirical data such as blood pressure and oxygen levels. Objective data also include anthropometric data (systematic measurement of the physical properties of the human body, primarily dimensional descriptors of body size and shape). Anthropometric data reflect health and nutritional status and predicts performance, health, and survival of a person or group of people. It is the responsibility of the nurse to collect both types of data, ask follow-up inquiry-based questions, and form a plan based on clinical judgment and critical-thinking skills.

Proficiency in assessment includes knowledge in performing inspection, palpation, percussion, and auscultation of each body system. These techniques are used to auscultate heart sounds and assess perfusion through areas of the body, palpate for masses, and inspect irregularities in the skin including discoloration and edema. The nurse will perform many of these techniques to determine cardiovascular diseases (e.g., hypertension, arrhythmias, coronary artery disease, heart failure, valvular diseases) and peripheral vascular diseases (e.g., deep vein thrombosis (DVT), lymphedema, chronic venous insufficiency, Raynaud phenomenon, varicose veins).

Nursing Assessment

A thorough assessment of the cardiovascular system starts with a full history of the patient's current and past medical experiences as well as family history, especially related to heart disease. This along with a complete examination of the cardiovascular system, including peripheral vascular function, will help the nurse create a patient-specific nursing care plan with a comprehensive plan of action. Information gathered during the assessment such as subjective data and objective findings are critical to accurately recognizing and analyzing cues that could potentially be attributed to dysfunction.

Collecting Subjective Data

Subjective data are information that comes from the patient, the "subject." This is information that cannot be measured empirically and is often based on the perception of the patient. This information includes past and present medical history, family history, cardiac risk factors, symptoms, and current medications including vitamins, herbal remedies, and over-the-counter (OTC) medications. New or worsening symptoms should be documented and reported to the provider. Symptoms can include chest pain, shortness of breath (dyspnea), irregular pulse rate,

dizziness, fatigue, peripheral edema, poor peripheral circulation, decreased pulses in the lower extremities, fluttering in the chest, and pain in the upper back, neck, or abdomen. Additional symptoms, such as heartburn, indigestion, nausea, or vomiting may be benign; however, they can also be indicative of a myocardial infarction. Therefore, it is imperative that the nurse ask appropriate inquiry-based questions to clarify subjective information provided by the patient (Centers for Disease Control and Prevention, n.d.).

When conducting the interview and assessment, clarifying questions should first address any immediate need for intervention (e.g., severe chest pain, shortness of breath) that may be indicative of a serious problem (e.g., myocardial infarction). When the situation is determined not to be urgent, the nurse should continue asking clarifying questions to further assess the patient's condition (Table 24.5).

Complaint/ Symptom	Initial Questions	Follow-Up Clarifying Questions
Palpitations	• Have you ever noticed your heart feeling as if it is racing or "fluttering" in your chest? • Have you ever felt as if your heart "skips" a beat?	• Are you currently experiencing palpitations? • When did the palpitations start? • Have you previously been treated for palpitations? If so, what treatment did you receive?
Shortness of breath (dyspnea)	• Do you ever feel short of breath with activity? • Do you ever feel short of breath when at rest? • Do you feel short of breath when lying flat?	• What activities bring on the shortness of breath? • How long does it take you to recover? • Have you ever woken up from sleeping feeling short of breath (paroxysmal nocturnal dyspnea)? • Do you need extra pillows to help you breathe better when sleeping, or do you need to sleep in a chair (**orthopnea**)? How long have you done this? Has this recently changed?
Swelling (edema)	• Have you noticed swelling of your feet or ankles? • Do your rings, shoes, or clothing feel tight at the end of the day? • Have you noticed any unexplained, sudden weight gain? • Have you noticed any new abdominal fullness?	• Does elevating your feet make the swelling decrease? Is there anything that you do to decrease the swelling? • Has this feeling of swelling or restriction gotten worse? • How much weight have you gained? Over what time period have you gained this weight?
Dizziness (syncope)	• Do you ever feel lightheaded? • Do you ever feel dizzy? • Have you ever fainted?	• Can you describe what happened? • Did you have any warning signs? • Did this occur when you changed positions or stood up from a sitting or lying position?

TABLE 24.5 Clarifying Questions

Complaint/ Symptom	Initial Questions	Follow-Up Clarifying Questions
Poor peripheral circulation	• Do your hands or feet ever feel cold or look pale or bluish? • Do you have pain in your feet or lower legs when exercising?	• What, if anything, brings on these symptoms? • What level of activity brings on this pain? • Is there anything, such as rest, that makes the pain better?
Calf pain	• Do you currently have constant pain in your lower legs?	• Can you point to the area of pain with one finger?

TABLE 24.5 Clarifying Questions

When assessing pain, the nurse may want to use the multidimensional PQRSTU Pain Assessment Model.

- Provocation/Palliation: What brings on the pain? What relieves the pain?
- Quality/Quantity (characteristics and duration): Please describe the pain. How often has it been occurring?
- Region/Radiation: Where is the pain? Does it radiate anywhere?
- Severity: How would you rate the pain on a scale of zero to ten, where zero is no pain and ten is the worst possible pain you could ever imagine?
- Timing: When did the pain start? How long does the pain last?
- Understanding: What do you think is causing the pain?

PATIENT CONVERSATIONS

Assessing a Patient's Pain Using the PQRSTU Pain Assessment Model

Scenario: A 72-year-old male presents to an urgent care center with complaints of chest pain. The patient doesn't have any family or friends present. During the initial assessment, the triage nurse, Samantha, measured the patient's vital signs, initiated oxygen therapy, and determined that the patient was stable at this time. Another nurse walks into the patient's room to complete an assessment.

Nurse: Hi, my name is Richard. I am going to be your nurse today. Do you mind verifying your name and date of birth for me?

Patient: Sure, I am Abraham Cohen. My date of birth is September 23, 1952.

Nurse: Thank you. So, you mentioned to Samantha, the first nurse, that you've been experiencing some chest pain. Can you tell me what's going on?

Patient: I woke up this morning with really bad chest pain. It seems to have eased a bit but it's still bad.

Nurse: I'm sorry to hear about that. What makes it worse?

Patient: Well, nothing really, it's just sort of steady pain.

Nurse: Can you tell me if anything makes it feel better?

Patient: Um, sitting upright in a chair and not exerting any energy seems to help.

Nurse: How would you describe your pain?

Patient: Well, it's right here [patient pointing at the center of the chest] and its real sharp.

Nurse: On a scale of zero to ten, zero being no pain at all and ten being the worst possible pain you could ever imagine, how would you rate your pain?

Patient: I'd probably say about a seven.

Nurse: When did this begin?

Patient: Well, it started with what I thought was heartburn and it's been coming and going for a couple of days but seemed much worse this morning.

Nurse: Is it constant?

Patient: No.

Nurse: Where were you when it began?

Patient: This time I was in bed sleeping and it woke me up.

Nurse: I see. Have you used anything to treat it, any medications?

Patient: No.

Nurse: Can you tell me what you think might be causing this?

Patient: I'm not real sure. I was hoping it would go away but when it kept coming back I was afraid it might be a heart attack so thought I should come get it checked out.

Nurse: That was a good decision. So, now we're going to do a physical assessment. Hopefully this will give us a better understanding of what's going on. If you remember anything else while I'm examining you, please feel free to just speak up and tell me. And, if you have any questions, don't hesitate to ask. Most important, if you start to feel worse, tell me immediately.

Patient: Okay, great. Thank you.

Nurse: No problem. We'll start working to figure this out.

Obtaining Health History

The goal of obtaining a health history is to gain insight into the overall health status of the patient. Relevant information related to chronic illness can be revealed through patient interviews as well as discovery of prior illnesses that the patient has not been treated for resulting in lingering effects. In general, the health history will include the patient's medical history, allergies, surgeries, medications, and social history, and the patient's family history.

When gathering a comprehensive medical history as it pertains to cardiovascular health, there are several key points for the nurse to consider. This includes an in-depth exploration of existing medical conditions, ongoing treatments, and any lingering effects from previous illnesses. Recognizing chronic or pervasive symptoms will help the nurse identify areas that require further evaluation.

For example, current symptoms such as shortness of breath, palpitations, chest pain, and edema may point to a cardiovascular origin. The nurse should ask if the patient has a history of any cardiac conditions, including short-term infections or illnesses (e.g., endocarditis, rheumatic fever, heart attacks) and long-term or chronic conditions (e.g., heart failure, high blood pressure, valvular disease). The nurse should also ask if the patient has a family history of heart disease—for example, a sibling or parent who had a heart attack or sudden cardiac death. It's important to find out, if possible, the age at which family members experienced these events.

The nurse also needs to assess cardiovascular disease risk factors that may be present in the patient's lifestyle, such as their diet, smoking status, substance use, alcohol use, sleep habits, stress levels, and physical activity. In taking a social history, the nurse should also consider whether the patient's job or leisure activities (such as travel) could be risk factors for heart disease.

Asking a patient about their current medication use is also important, not just to ascertain whether they are being treated for a cardiovascular condition (and are complying with treatment) but also to determine whether they are taking any medications that could have cardiovascular contraindications or side effects. For example, popular OTC supplements that contain stimulating substances such as caffeine or ginseng may cause palpitations. Certain prescription drugs (e.g., erythromycin) can cause QT prolongation.

In taking a detailed medication history, particularly in older patients or those with multiple chronic conditions, the nurse should be aware of an increasing number of medications that patients may be taking and the potential for drug-to-drug interactions. This relates not just to prescriptions, but to OTC drugs, herbs, supplements, and vitamins as well.

Allergies are of utmost importance for all patients because of the potential for life-threatening consequences. Clear communication is key when asking about medication allergies, ensuring a thorough understanding of the patient's reactions. Questions regarding allergies should cover more than just medications. The nurse should also inquire about allergies, sensitivities, or reactions to other substances (e.g., latex, medical/bandage tape, antiseptic solutions) as well as any herbs and vitamins.

Certain aspects of the medical history may be tailored to specific situations. Age and gender often guide healthcare professionals in determining when to inquire about additional details. For infants, parents should be asked about complications during pregnancy and delivery, and prematurity. Immunization status is crucial for pediatric patients, and it remains relevant for older adults with an increasing array of vaccination options making it an integral part of medical history assessments.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Evidence-Based Practice

Definition: Integrate current evidence regarding best practices with clinical expertise; also incorporate patient/family preferences and values for delivery of optimal health care.

Knowledge: Demonstrate knowledge of basic scientific methods and processes

Skill: Participate effectively in appropriate data collection and other research activities. The nurse will ask questions such as:

- Have you ever been diagnosed with any heart or circulation conditions, such as high blood pressure, coronary artery disease, peripheral vascular disease, high cholesterol, heart failure, or valve problems?
- Have you ever had a heart attack or stroke?
- Have you had any procedures performed to improve your heart function, such as ablation or stent placement?

Attitude: Appreciate strengths and weaknesses of the scientific basis for practice.

Past History

Identifying both acute and chronic illnesses for which the patient has been treated in the past, as well as any untreated illness, is instrumental in recognizing current risk factors and symptoms that may contribute to current and future health status. A history of chronic respiratory illness, diabetes, obesity, and kidney disease can adversely affect the patient's overall health and place the patient at risk for cardiovascular disease. Surgical history is also considered, encompassing all invasive procedures the patient has undergone. Information collected from the past history can often direct treatment, identify areas in need of further evaluation, and avoid potential harm to the patient.

Family history plays a crucial role, offering insights into potential genetic predispositions to certain diseases. It is important to gather information related to parents and siblings to determine risk factors and genetic disposition for heart disease.

Social History

Social history is a broad category that covers the patient's lifestyle factors, such as smoking or tobacco use, alcohol and drug history, spirituality, mental health, and relationship aspects. Occupational details, hobbies, and sexual activity are also part of this inquiry. Further probing may be necessary if there are concerns about health risks or a connection to the current disease state.

Asking about smoking or tobacco use as well as alcohol and drug use should include how much, how often, and how long. If the patient has smoked in the past, the questions should be centered around when stopped and how long the patient smoked at that time. Alcohol-related questions should include type of alcohol (beer, wine, liquor), how

many drinks per day/week/month, and any history of alcohol dependency. Drug usage, abuse, and dependency should include both prescribed and recreational or illegal drugs. The type of medication, medication name, how often, and any adverse effects should be documented.

Identify Risk Factors

To mitigate any potential cardiac dysfunction, it is important to identify risk factors that may contribute to cardiovascular disease. Some risk factors may be attributed to social history such as smoking, alcohol, and drug use. Other risk factors may include information from the past medical history and family history.

REAL RN STORIES

A Heart-to-Heart

Name: Jess, RN
Clinical setting: OB-GYN office
Years in practice: 8
Facility location: A small clinic in the Midwest

I recently had a patient; her name was Lisa. She came in with her partner, Cole, for her first prenatal visit. She was new to the practice, so we were going through her medical history. Lisa and Cole were both teachers in their early 30s who had moved to the area to take jobs at the local high school. This was Lisa's first pregnancy, and she hadn't had any trouble getting pregnant. Actually, she said they got pregnant a lot quicker than they thought they would, so she was nervous that "things were happening so fast."

When we started talking about her medical history, which was pretty unremarkable because she was young and healthy, I noticed that she started to get tearful. Her parents were in great health, she told me, but her younger brother . . . she started to cry, and Cole stepped up to fill me in.

When Lisa was a teen, her brother Scotty had died suddenly during a soccer game. He had just "passed out and died" on the field without warning. It was very traumatic for everyone, but especially Lisa because they had been so close. Scotty was a healthy, athletic kid, and Lisa's family thought that him dying of sudden cardiac arrest "didn't make sense."

Lisa told me that since Scotty died, she'd always had a fear in the back of her mind that she could die the same way—without warning, and "from some unknown heart thing." But since she'd found out she was pregnant, she'd become consumed with anxiety that "whatever killed Scotty might be passed on to my baby."

I started by acknowledging her concern and making sure she felt heard and that her feelings were valid. I also reassured her that the doctor would be able to answer questions and address her fears. They would be able to discuss things such as genetic screenings and prenatal testing, and because technology has come so far, we can even spot some congenital heart problems in utero today.

I also asked her if she had someone to talk to about Scotty, and she admitted that she "probably needed therapy." I offered to connect her with the social worker who is part of our office team, and she seemed relieved.

I remember the next time she came in, she stopped me in the hallway and thanked me. The prenatal and genetic tests had come back negative. But she said that the biggest thing was that after she "spoke up about the fear" it was like a weight had been lifted from her shoulders—or maybe, her heart.

The nurse will follow through with additional questions related to any potential risk factors to analyze the severity and potential impact on overall health (Table 24.6).

Question	Follow-Up Questions
Have your parents or siblings been diagnosed with any heart conditions?	• If yes, who has what conditions?
Do you smoke or vape?	• If yes, how many do you smoke/vape daily? • For how many years have you smoked/vaped?
If you do not currently smoke, have you smoked in the past?	• If yes, what did you smoke? • How old were you when you started? When did you stop smoking? • For how many years did you smoke?
Are you physically active during the week?	• How many times per week do you exercise and for how many minutes? • What type of exercise do you usually do?
What does your diet look like on a typical day?	• How many fruits and vegetables do you normally eat in a day? • Do you monitor the amount of saturated fats you eat? • How many times a week do you eat a meal prepared by a restaurant? • Do you pay attention to salt in your diet? Do you add salt to your food before tasting it? • Do you have caffeine during the day? If so, how much?
Do you drink alcoholic drinks?	• How many alcoholic drinks do you have on average per day? Per week? • Do you drink while at work?
Would you say you experience stress in your life?	• How would you rate the amount of stress in your life from zero to ten (zero is no stress and ten is the worst imaginable stress)? • How do you cope with the stress in your life?
How many hours of sleep do you normally get each day?	• Do you have difficulty falling asleep? • Do you have difficulty staying asleep?

TABLE 24.6 Obtaining Information Related to Risk Factors

Although some risk factors cannot be changed, such as genetic predisposition, other factors are modifiable. Globally, CVDs (heart and blood vessel diseases) are a significant health challenge. CVD is influenced by factors such as high blood sugar, high blood pressure, high cholesterol, and obesity. Evidence suggests that having multiple modifiable risk factors can make the condition more severe. From 1990 to 2019, the number of CVD cases almost doubled, with about 523 million people affected and 18.6 million deaths in 2019 (Kumma, 2022). According to the American Heart Association (n.d.), major modifiable risk factors for CVD include smoking, high blood pressure, high cholesterol, physical inactivity, obesity, and diabetes. These factors can occur individually or in combination with other factors. Factors such as age, gender, residence, altitude, education, and socioeconomic status are associated with having multiple modifiable CVD risk factors.

Validated risk assessment tools are available to help estimate an individual's likelihood of experiencing a stroke or heart attack in the next ten years. These tools, such as the BE-FAST and RACE assessments, use general practice data and consider factors such as age, gender, family history, smoking, atrial fibrillation, chronic kidney disease,

body mass index, blood pressure, and lipid levels. The BE-FAST (Balance-Eyes-Face-Arms-Speech-Time) is an easy to administer, quick assessment tool that can be conducted by both licensed and unlicensed health professionals (El Ammar et al., 2020). The RACE (Rapid Arterial Occlusion Evaluation) is a longer assessment tool that can identify larger vessel occlusion (American Heart Association, 2019). Other assessment tools such as the Cincinnati Pre-Hospital Stroke Scale (CPSS), the Los Angeles Motor Scale (LAMS), and the Miami Emergency Neurological Deficit (MEND) are also used to assess for stroke activity (Fussner & Velasco, n.d.). If an individual's estimated CVD risk score is 10 percent or more, pharmacological therapies targeting blood pressure and/or lipid levels are recommended. Lifestyle advice is offered to individuals at all risk levels, including those with a risk score below 10 percent, based on their specific needs, as per the hypertension clinical guideline from the National Institute for Care and Health Excellence, or NICE (2023).

LINK TO LEARNING

Comprehensive graded recommendations for screening tests across cultures and the life span (https://openstax.org/r/77StatinUse) are provided by the U.S. Preventive Services Task Force.

After completing a risk assessment, the focus often shifts to managing factors closely tied to CVD risk (e.g., hypertension, dyslipidemia, smoking). According to NICE, hypertension is suspected if clinic blood pressure is 140/90 mm Hg or more, with home readings of 135/85 mm Hg or greater (NICE, 2023). Treatment decisions depend on comorbid conditions or CVD risk scores. If diagnosed with stage 1 hypertension, lifestyle changes are recommended, and medication may be offered for those with pre-existing conditions or a risk score of 10 percent or more. In stage 2 hypertension, medication is always recommended.

Dyslipidemia, another critical risk factor, is managed based on patient profiles or an overall CVD risk score of 10 percent or more (NICE, 2023). Statins are recommended for those with established CVD. When calculating CVD risk, the ratio of total cholesterol to HDL cholesterol is used, and the non-HDL cholesterol should be 2.5 mmol/mol or less.

Detecting atrial fibrillation (AF) is vital for reducing stroke risk. Manual pulse checks should be part of a CVD assessment, and if AF is diagnosed, stroke risk should be assessed, and anticoagulants may be prescribed.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Evidence-based Practice

Definition: Describe reliable sources for locating evidence reports and clinical practice guidelines.

Knowledge: Nurses must distinguish between clinical opinion-based reports and those referencing clinical evidence and research summaries. Because nurses provide most patient education on CVD and associated conditions and risk factors, they must continually review recommendations that guide clinical practice. Focusing on guidelines from the American Heart Association, reviewing evidence-based reports on new treatment options, and familiarizing themselves with outcome goals gives nurses an advantage in providing the most up-to-date care for their patients.

Skill: Nurses can be alert for progressive changes in biomarkers such as serum lipid tests, blood pressure changes, edema, and subtle chest pain. The nurse can empower their patients to pursue lifestyle modification by providing clinical education based on evidence-based data that clearly shows the benefit of these actions. Depending on patient motivation and health literacy, nurses can adjust the level and depth of teaching while still promoting evidence-based practice. The nurse focuses on patient needs and concerns while incorporating contemporary treatment guidelines to fit the patients' circumstances.

Attitude: A focus on evidence-based practice enhances the nurse's professional presence, promotes the best outcomes for patients, and guides patient-centered care.

Nursing Assessment: Collecting Objective Data

The physical assessment of the cardiovascular system involves collecting data and interpreting findings related to vital signs; inspection, palpation, and percussion of the CVS; and auscultation (e.g., heart sounds, bruits). Collection of objective data also includes assessing heart rate and rhythm and gathering and reviewing diagnostic test results.

During the assessment, the nurse evaluates for sufficient perfusion and cardiac output. Tools such as a sphygmomanometer or blood pressure cuff (an instrument for measuring blood pressure, typically consisting of an inflatable rubber cuff that is applied to the arm), a stethoscope, penlight, tape measure, and pulse oximeter are used to collect data related to blood flow, blood pressure, edema, and oxygenation.

The first step in a physical assessment is to Identify the patient's level of consciousness (LOC). Is the patient conscious and able to follow simple instructions and answer basic questions? The patient should be alert and cooperative. If not, assessment should be geared toward why the patient's LOC is diminished including obtaining vital signs and testing for cardiac activity. Blood pressure, pulse readings, and oxygenation are interpreted to verify that the patient is stable before proceeding with the physical assessment. During this phase of the assessment, perfusion is evaluated. Several cardiac conditions can adversely affect cardiac output and perfusion in the body. There are several medications used to enhance a patient's cardiac output and maintain adequate perfusion to organs and tissues throughout the body.

Assessing a patient's oxygenation status is commonly accomplished using pulse oximetry (the saturation of peripheral oxygen [SpO_2]), which measures the saturation of hemoglobin with oxygen in peripheral blood. The target SpO_2 range for adults is 94 to 98 percent, but for individuals with chronic conditions such as chronic obstructive pulmonary disease (COPD), the target may be lower at 88 to 92 percent. Although SpO_2 is a convenient and noninvasive method, it may not always be entirely accurate. Conditions such as severe anemia, reduced extremity perfusion, or exposure to substances (e.g., carbon monoxide) can affect SpO_2 readings, leading to potential inaccuracies.

Inspection

Visual observation of areas of the body to assess for symmetry, color, movement, swelling, and obvious alterations in body function is called **inspection** (Table 24.7). For example, using the acronym **CWMS** (color-warmth-movement-sensation) helps the nurse efficiently and thoroughly inspect the extremities noting edema, numbness, and capillary refill. Alterations and bilateral inconsistencies in CWMS may indicate underlying conditions or injury. The face, lips, and ears are inspected for **cyanosis** or **pallor**, which may be caused by reduced blood flow, abnormal oxygenation levels, or a decreased number of red blood cells.

Area/What/Reason	Abnormal Findings
Skin: Color Assess for perfusion by inspecting the face, lips, and fingertips for cyanosis or pallor.	• Cyanosis is a bluish discoloration of the skin, lips, and nail beds, which if present indicates decreased perfusion and oxygenation. (credit: modification of work "Benzocaine-Induced Cyanosis" by National Library of Medicine; CC BY 2.0) • Pallor is the loss of color, or paleness, of the skin or mucous membranes caused by reduced blood flow, reduced oxygenation, or decreased number of red blood cells. Note: Patients with light skin tones should be pink in color. In patients with darker skin tones, the nurse should assess for pallor on the palms, conjunctiva, or inner aspect of the patient's lower lip.
Neck: Jugular vein Assess for distention.	• **Jugular venous distension (JVD)** appears as a bulge over the jugular vein, making it most visible on the right side of a person's neck. This occurs when increased pressure of the superior vena cava causes JVD. It should not be present in the upright position or when the head of the bed is at 30 to 45 degrees.

TABLE 24.7 Important Aspects of Cardiovascular and Peripheral Vascular System Inspection

Area/What/Reason	Abnormal Findings
Chest: Precordium Inspect the chest area over the heart for abnormalities, scars, or any abnormal pulsations that the underlying cardiac chambers and great vessels may produce.	• A structural deformity of the anterior chest wall (sternum and four or five ribs bilaterally) is known as **pectus excavatum**. This causes the sternum to be caved in so it appears sunken into the chest. This congenital condition may be present at birth or may develop during puberty. When severe, pectus excavatum can eventually adversely affect cardiac and respiratory function, can displace or rotate the heart, and can cause pain in the chest and back. (credit: "Untitled" by ACC1Ó–- Competitivitat per 'empresa/Flickr, CC BY 2.0)

TABLE 24.7 Important Aspects of Cardiovascular and Peripheral Vascular System Inspection

Area/What/Reason	Abnormal Findings
Extremities: Legs, feet, toes, arms, hands, and fingers Inspect bilaterally for changes in color, warmth, movement, and sensation (CWMS).	• Upper extremities: Inspect the fingers, arms, and hands for alterations or bilateral inconsistency in CWMS, which may indicate underlying conditions or injury. Assess capillary refill by compressing the nail bed until it blanches and record the time taken for the color to return to the nail bed. Normal capillary refill is less than three seconds. (credit: "Assess capillary refill.jpg" by Glynda Rees Doyle and Jodie Anita McCutcheon/ Wikimedia Commons; CC BY 4.0) • Lower extremities: Inspect the toes, feet, and legs bilaterally, noting CWMS, capillary refill, and the presence of peripheral edema, superficial distended veins, and hair distribution. Document the location and size of any skin ulcers. • Edema: Note any presence of edema. Peripheral edema is swelling that can be caused by infection, thrombosis, or venous insufficiency due to an accumulation of fluid in the tissues. (credit: modification of work from *Anatomy and Physiology*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license) • **Deep vein thrombosis (DVT)**: DVT is a blood clot that forms in a vein deep in the body. DVT requires emergency notification of the healthcare provider and immediate follow-up because of the risk of developing a life-threatening **pulmonary embolism**. Inspect the lower extremities bilaterally. Assess for size, color, temperature, and for the presence of pain in the calves. Unilateral warmth, redness, tenderness, swelling in the calf, or sudden onset of intense, sharp muscle pain that increases with dorsiflexion of the foot is an indication of a DVT. • Clubbing of nails: Clubbing is when fingernails appear wider, spongelike, or

TABLE 24.7 Important Aspects of Cardiovascular and Peripheral Vascular System Inspection

Area/What/Reason	Abnormal Findings
	swollen, resembling an upside-down spoon. This is most often attributed to interstitial lung disease and lung cancer, which affects perfusion of oxygenated blood. However, clubbing may indicate underlying cardiovascular dysfunction (e.g., axillary artery aneurysm, brachial arteriovenous malformations, platelet-related disease). (credit: "ClubbingCF.JPG" by Jerry Nick, M.D./Wikimedia Commons, CC BY 3.0)

TABLE 24.7 Important Aspects of Cardiovascular and Peripheral Vascular System Inspection

Palpation

Using the fingers or hand to assess size, consistency, texture, location, and tenderness of an organ, body part, or body area is called **palpation**. It is a method used to evaluate peripheral pulses, capillary refill, and lymph nodes and to look for the presence of edema. When palpating these areas, also pay attention to the temperature and moisture of the skin.

Capillary Refill

The **capillary refill** test is performed on the nail beds to monitor perfusion. Pressure is applied to a fingernail or toenail until it pales, indicating that the blood has been forced from the tissue under the nail. This paleness is called blanching. After the tissue has blanched, the pressure is removed. Capillary refill time is defined as the time it takes for the color to return after pressure is removed. If there is sufficient blood flow to the area, a pink color should return within two seconds or less after the pressure is removed. However, some research indicates that a capillary refill time of less than three seconds may be considered normal in some patients (e.g., pediatric patients).

LINK TO LEARNING

This nurse provides a walk-through instruction on capillary refill (https://openstax.org/r/77CapRefillInst) that you can review and practice to ensure understanding.

Edema

Edema occurs when visible swelling of the extremities is seen, which is caused by a buildup of fluid within the tissues. If edema is present on inspection, palpate the area to determine if the edema is pitting or nonpitting. Press on the skin to assess for indentation, ideally over a bony structure, such as the tibia. If no indentation occurs, it is referred to as nonpitting edema. If indentation occurs, it is referred to as pitting edema (Figure 24.20).

FIGURE 24.20 Assess lower extremities for pitting edema by pressing into the skin and observing for indentations. (credit: modification of work "Oedema, finger marks" by John Campbell/Flickr, Public Domain)

The nurse should note the depth of the indention and how long it takes for the skin to rebound back to its original position. The depth of the indentation and time required to rebound to the original position are graded on a scale from 1 to 4 (Table 24.8). Additionally, it is helpful to note that edema may be difficult to observe in a patient with a higher weight. It is also important to monitor for any sudden increase in weight, which is considered a probable sign of fluid volume overload.

Grade	Description	Depth of Indentation	Time to Return to Normal
+1	Trace: • Trace pitting • No visible change in the shape of the extremity	0–2 mm	Rapidly (< 2 seconds)
+2	Mild: • Mild pitting • Swelling with no visible change in the shape of the extremity	3–4 mm	Up to 15 seconds
+3	Moderate: • Deep pitting • Swelling is more intense in the area	5–6 mm	More than 1 minute
+4	Severe: • Very deep pitting • Very swollen, distorted extremity	7 mm or more	More than 2 minutes

TABLE 24.8 Rating Edema

Peripheral Pulses

During the palpation phase of a nursing assessment, the nurse should compare the rate, rhythm, and quality of

arterial pulses bilaterally, including the carotid, radial, brachial, posterior tibialis, and dorsalis pedis pulses. Bilateral comparison for all pulses (except the carotid) is important for determining subtle variations in pulse strength. Carotid pulses should be palpated on one side at a time to avoid decreasing perfusion of the brain. The posterior tibial artery is located on the medial aspect of the foot just behind the medial malleolus (Figure 24.21). It can be palpated by placing your fingertips on the area just behind and slightly below the medial malleolus.

FIGURE 24.21 Posterior tibial pulses are assessed by palpating just behind and slightly below the medial malleolus (ankle bone). (credit: "Assessing Tibial Pedal Pulses" by Chippewa Valley Technical College; CC BY 4.0)

The dorsalis pedis artery is located just lateral to the extensor tendon of the big toe on the top of the foot and can be identified by asking the patient to flex the toe while you provide resistance to this movement (Figure 24.22). Gently place the tips of your second, third, and fourth fingers adjacent to the tendon, and try to feel the pulse.

FIGURE 24.22 Dorsalis pedis pulses are assessed by palpating the top of the foot at the first intermetatarsal space located on the side of the tendon that moves the large toe. If possible, have the patient extend their big toe upward to help locate this space. (credit: "Assessing Dorsalis Pedis" by Chippewa Valley Technical College; CC BY 4.0)

The quality of the pulse is graded on a scale of 0 to 4. Absent (0), weak (+1), normal (+2), strong (+3), full and bounding (+4). If unable to palpate a pulse, additional assessment is needed. First, determine if this is a new or chronic finding. Second, if available, use a Doppler ultrasound to determine the presence or absence of the pulse. An absent pulse could be a sign of an emergent condition requiring immediate follow-up and provider notification.

Percussion

The term **percussion** involves tapping the chest wall with the fingers to assess sound that may indicate an abnormality or dysfunction. This method of examination involves hyperextending the fingers of one hand with the middle distal finger placed firmly on the chest wall. Holding the opposite hand close to the hand on the patient, the middle finger of the second hand is retracted and the distal finger is firmly struck.

Resonant sounds can be heard when percussing the precordial area of the chest, which indicates normal tissue beneath the fingers used. When percussing over the lungs, the resonant sounds will be a semihollow, medium-pitched sound. Denser tissue, such as the heart will yield a flat or dull sound. Percussion is most often used to

determine masses and blockages so it has a limited use in nursing. Auscultation will yield more accurate results and is much easier to conduct.

Auscultating Heart Sounds

The process of using a stethoscope to listen for normal and abnormal sounds (e.g., components of the heartbeat, murmurs, valvular sounds, bruits) is known as **auscultation**. When assessing the heart, auscultation is routinely performed over five specific areas of the heart to listen for corresponding valvular sounds. These auscultation sites are often referred to by the mnemonic APE To Man, referring to the Aortic, Pulmonic, Erb's point, Tricuspid, and Mitral areas (Figure 24.23). The aortic area is the second intercostal space to the right of the sternum. The pulmonic area is the second intercostal space to the left of the sternum. Erb's point is directly below the pulmonic area and located at the third intercostal space to the left of the sternum. The tricuspid (or parasternal) area is at the fourth intercostal space to the left of the sternum. The mitral area (also called the apical or left ventricular area) is the fifth intercostal space at the midclavicular line.

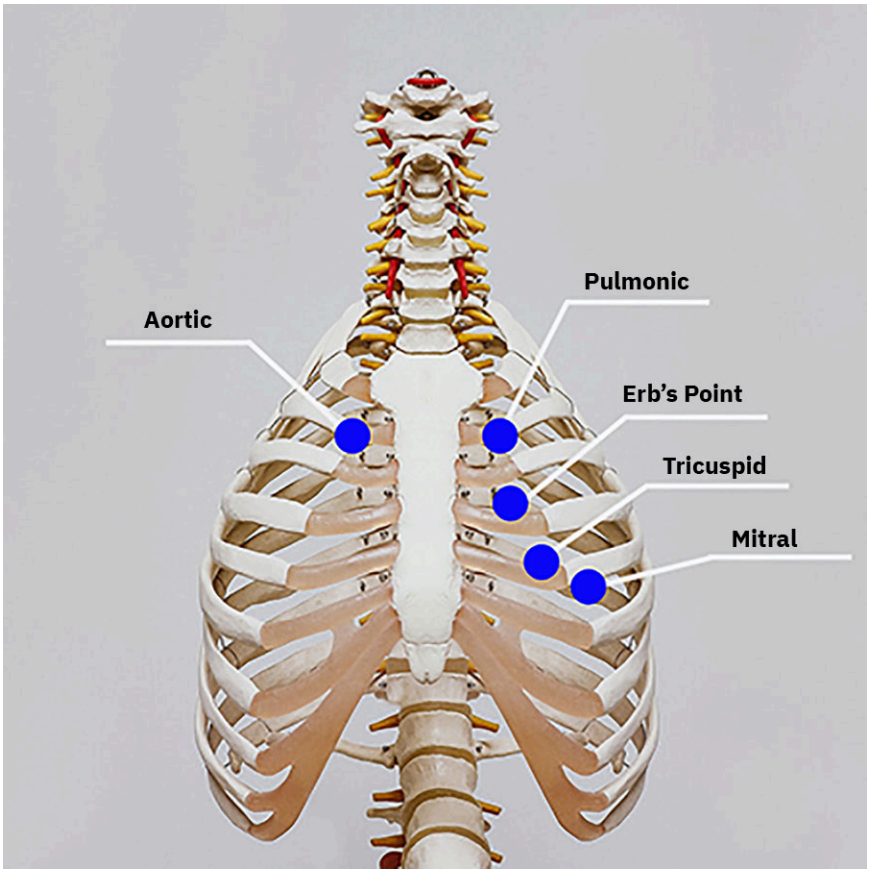


FIGURE 24.23 Using the correct landmarks of auscultation for heart sounds is critical to ensuring accurate results. (credit: "Cardiac Auscultation Areas" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

Auscultation usually begins at the aortic area (upper right sternal edge). Use the diaphragm of the stethoscope to carefully identify the S1 and S2 sounds, which make a "lub-dub" sound. Note that when listening over the area of the aortic and pulmonic valves, the "dub" (S2) will sound louder than the "lub" (S1). Move the stethoscope sequentially to the pulmonic area (upper left sternal edge), Erb's point (left third intercostal space at the sternal border), and tricuspid area (fourth intercostal space). When assessing the mitral area for female patients, it is often helpful to ask them to lift up their breast tissue so the stethoscope can be placed directly on the chest wall.

Repeat this process with the bell of the stethoscope. The apical pulse should be counted over a sixty-second period. For an adult, the heart rate should be between sixty and one hundred with a regular rhythm to be considered within normal range. The apical pulse is an important assessment to obtain before the administration of many cardiac medications.

The first heart sound ("lub") is designated as **S1**, which identifies the onset of systole, when the atrioventricular (AV)

(mitral and tricuspid) valves close and the ventricles contract and eject the blood out of the heart. The second heart sound ("dub") is designated as **S2**, which identifies the end of systole and the onset of diastole when the semilunar (pulmonic and aortic) valves close, the AV valves open, and the ventricles fill with blood. S1 corresponds to the palpable pulse. When auscultating, it is important to identify the S1 ("lub") and S2 ("dub") sounds, evaluate the rate and rhythm of the heart, and listen for any extra heart sounds. Nurses should listen to a normal S1/S2 sound and then compare them to abnormal sounds. It may be helpful to use earbuds or a headphone.

Extra heart sounds include clicks, murmurs, S3 and S4 sounds, and pleural friction rubs. These extra sounds can be difficult for a novice to distinguish, so if any new or different sounds are noticed, consult an advanced practitioner or notify the provider. A midsystolic click, associated with mitral valve prolapse, may be heard with the diaphragm at the apex or left lower sternal border.

A click may be followed by a **murmur**. A murmur is a blowing or whooshing sound that signifies turbulent blood flow often caused by a valvular defect. New murmurs not previously recorded should be immediately communicated to the healthcare provider. In the aortic area, listen for possible murmurs of aortic stenosis and aortic regurgitation with the diaphragm of the stethoscope. In the pulmonic area, listen for potential murmurs of pulmonic stenosis and pulmonary and aortic regurgitation. In the tricuspid area, at the fourth and fifth intercostal spaces along the left sternal border, listen for the potential murmurs of tricuspid regurgitation, tricuspid stenosis, or a ventricular septal defect.

If present, S3 and S4 sounds are often heard best by asking the patient to lie on their left side and listening over the apex of the heart with the bell of the stethoscope. An S3 sound, a **ventricular gallop**, occurs after the S2 and sounds like "lub-dub-dah," or a sound similar to a horse galloping. An S3 can occur when a patient is experiencing fluid overload, such as during an acute exacerbation of heart failure. It can also be a normal finding in pregnancy due to increased blood flow through the ventricles.

The S4 sound, an **atrial gallop**, occurs immediately before the S1 and sounds like "ta-lub-dub." An S4 sound during diastole may be created by the movement of blood out of the atria flowing against a stiff ventricular wall caused by hypertension, pulmonary hypertension, ventricular outflow obstruction, or ischemic heart disease.

A **pericardial friction rub** is a grating, to-and-fro sound or creaky-scratchy noise generated as the parietal and visceral membranes rub together, which is caused by inflammation of the pericardium. It is best heard with the diaphragm of the stethoscope at the apex or left lower sternal border as the patient sits up, leans forward, and holds their breath.

The carotid artery may be auscultated for **bruit**, a swishing sound caused by turbulence in the blood vessel. Bruits may be heard because of atherosclerotic changes.

Assessing Heart Rate and Rhythm

Pulses can be found at many points on the body and all could theoretically be used to assess heart rate. When palpating pulses, use moderate pressure, because too much pressure can impair blood flow and occlude the vessel. In some facilities, scales are used to document the quality of the pulse, such as absent (0), weak (+1), normal (+2), strong (+3), and full and bounding (+4).

If a pulse is regular, a thirty-second count multiplied by two is generally acceptable. If a pulse is irregular, the nurse should count for a full sixty seconds. A common pulse for assessment is the radial pulse (Figure 24.24).

FIGURE 24.24 Use the pads of your first two fingers to gently palpate the radial pulse at the inner lateral wrist. (credit: "Untitled" by Thompson Rivers University; CC BY 4.0)

The apical pulse is another common pulse and should be auscultated for rate and regularity (Figure 24.25). For accuracy, an apical heart rate should be taken for a full minute especially when giving medications that are dependent on the heart rate.

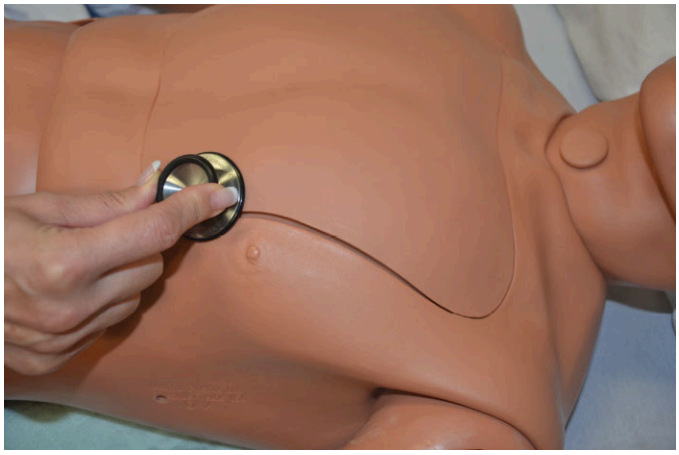


FIGURE 24.25 Apical pulses are assessed using a stethoscope placed over the fourth to fifth intercostal space of the midclavicular line on the left side on adults. (credit: "Untitled" by Thompson Rivers University; CC BY 4.0)

It is suggested that beginner nurses concentrate on rate and regularity. With practice, and depending on work location, skill level with specific heart sounds may improve, at which point the nurse will document in greater detail.

A carotid pulse may be taken when the radial pulse is not present or is difficult to palpate (Figure 24.26). It is important that the nurse NOT palpate both bilateral carotid arteries at the same time, to avoid decreasing perfusion of the brain.

FIGURE 24.26 When palpating the carotid pulse, use the pads of your first three fingers to gently palpate on either side of the trachea. (credit: "Assessing carotid pulse" by Thompson Rivers University; CC BY 4.0)

Diagnostic Testing

Cardiovascular diagnostic and screening tests offer comprehensive insights into the heart's electrical activity, heartbeat rhythm, and efficiency of blood pumping through the heart's chambers and valves into the coronary arteries and to the heart muscle. Other tests help providers identify the presence of tumors or other abnormalities in the structure of the cardiovascular system.

There are numerous types of diagnostic tests for cardiovascular disease including blood laboratory tests; electrocardiograms; echocardiograms; stress tests; electrophysiology studies; cardiac catheterization; and magnetic resonance imaging (MRI), magnetic resonance angiography (MRA), computed tomography (CT), and positron emission tomography (PET) scans. New tests are continually being developed and tested to ensure the safest avenues to obtain the most accurate results. It is important to recognize patient needs and abilities to perform some diagnostic tests as well as identify allergies or adverse events that may be associated with using a contrast medium.

Basic blood panels with complete blood counts and prothrombin platelet times are tested to evaluate blood components for blood clotting, anemia, diabetes, and other contributing factors to CVD. The D-dimer test measures fragments of protein that a body releases when a blood clot dissolves. It can help diagnose and monitor blood-clotting conditions such as DVT. Electrolytes can be used to screen for imbalances in potassium, sodium, or calcium, which may affect cardiac function and conduction. Increased cardiac enzymes (e.g., troponin, creatine kinase-MB [CK-MB]) can indicate ischemia, myocardial damage, or infarction. The antinuclear antibody profile is used to help diagnose autoimmune disorders, which may indicate an increased risk for CVD. Another important blood test is the B-type natriuretic peptides (BNP), which measures the levels of BNP protein in the bloodstream. High levels of BNP can be a sign of heart failure. Additional blood tests include testing for cholesterol and triglyceride levels to monitor for hyperlipidemia, which may suggest a risk of atherosclerosis or coronary artery disease.

Healthcare providers may use arterial blood gas (ABG) measurements, a more specific evaluation of oxygen and carbon dioxide levels, particularly in emergency situations involving deteriorating respiratory status. An ABG involves drawing blood from the radial artery, and provides insights into oxygen, carbon dioxide, pH, and bicarbonate levels. The partial pressure of oxygen (PaO_2) in arterial blood measures the pressure of oxygen dissolved in the blood, offering a more accurate assessment than SpO_2 because it is not influenced by hemoglobin levels. The normal PaO_2 level for a healthy adult ranges from 80 to 100 mm Hg. Additionally, ABGs provide information about the partial pressure of carbon dioxide ($PaCO_2$) in arterial blood and how well carbon dioxide can move out of the body; this assesses ventilation efficiency at the alveolar level. The normal $PaCO_2$ level is 35 to 45 mm Hg. The results of an ABG test also include pH levels (7.35–7.45), bicarbonate levels (22–26 mEq/L), and the calculated arterial oxygen saturation level (SaO_2). Nurses need to become versed with the normal values for common blood test values (Table 24.9).

Complete Blood Count	
Laboratory Test	**Reference Range**
Red blood cell count	Male: 4.7–6.1 million cells/mcL Female: 4.2–5.4 million cells/mcL
Hemoglobin (Hgb)	12–16 g/dL or 7.4–9.9 mmol/L
Hematocrit (Hct)	37–47% or 0.37–0.47 volume fraction
Mean corpuscular volume (MCV)	80–95 fL
Mean corpuscular hemoglobin (MCH)	27–31 pg
Mean corpuscular hemoglobin concentration (MCHC)	32–36 g/dL or 320–360 g/L
White blood cell count	5,000–10,000/mm^3 or 5–10 × 10^9/L
Neutrophils	55–70% or 2,500–8,000/mm^3
Lymphocytes	20–40% or 1,000–4,000/mm^3
Monocytes	2–8% or 100–700/mm^3
Eosinophils	1–4% or 50–500/mm^3
Basophils	0.5–1% or 25–100/mm^3
Platelet count	150,000–400,000/mm^3 or 150–400 × 10^9/L
Electrolytes	
Laboratory Test	**Reference Range**
Calcium (electrolyte)	9.0–10.5 mg/dL or 2.25–2.62 mmol/L
Chloride (electrolyte)	98–106 mEq/L or 98–106 mmol/L
Cholesterol, serum	< 200 mg/dL or < 5.20 mmol/L (SI units)
CO_2	23–30 mEq/L or 23–30 mmol/L
Glucose	74–106 mg/dL or 4.1–5.9 mmol/L
Potassium (electrolyte)	3.5–5 mEq/L or 3.5–5 mmol/L
Sodium (electrolyte)	136–145 mEq/L or 136–145 mmol/L
Magnesium	1.3–2.1 mEq/L

TABLE 24.9 Common Blood Test Values

Phosphate	3–4.5 mg/dL
Total bilirubin	0.3–1.0 mg/dL or 5.1–17 µmol/L
Total protein	6.4–8.3 g/dL or 64–83 g/L

Cardiac Biomarkers

Laboratory Test	Reference Range
Troponin	< 0.04 ng/ml
Creatinine kinase-MB (CK-MB)	< 4% (Women < 4 mg/mL; Men < 7.8 ng/mL)
Antinuclear antibody profile	Negative at 1:40 dilution
B-type natriuretic peptides (BNP)	< 100 pg/mL
D-Dimer	< 0.4 mcg/mL

Lipid Profile

Laboratory Test	Reference Range
Fasting cholesterol Low risk for coronary heart disease (CHD) Borderline risk for CHD High risk for CHD	 < 200 mg/dL 200–239 mg/dL > 240 mg/dL
Triglycerides Low risk for CHD Borderline risk for CHD High risk for CHD	 < 149 mg/dL 150–199 mg/dL > 200 mg/dL
High-density lipoprotein (HDL)	> 40 mg/dL
Low-density lipoprotein (LDL) Low risk for CHD Borderline risk for CHD High risk for CHD	 < 100 mg/dL 100–159 mg/dL > 160 mg/dL

Arterial Blood Gases

Laboratory Test	Reference Range
pH	Adult/child: 7.35–7.45 2 months to 2 years: 7.34–7.46 Newborn: 7.32–7.49 pH (venous): 7.31–7.41

TABLE 24.9 Common Blood Test Values

$PaCO_2$	Adult/child: 35–45 mm Hg Child < 2 years: 26–41 mm Hg PCO_2 (venous): 40–50 mm Hg
HCO_3	Adult/child: 22–26 mEq/L Newborn/infant: 16–24 mEq/L
PaO_2	Adult/child: 80–100 mm Hg Newborn: 60–70 mm Hg PO_2 (venous): 40–50 mm Hg
O_2 sat	Adult/child: 95–100% Older adults: 95% Newborn: 40–90%
O_2 content	Arterial: 15–22 vol % Venous: 11–16 vol %
Base excess	0 ± 2 mEq/L

TABLE 24.9 Common Blood Test Values

Testing for heart rhythm and stability are electronic evaluations that assess for arrhythmias such as ventricular fibrillation, myocardial infarction, ischemia, and valvular dysfunction. An echocardiogram provides detailed images of the heart's structure and function, identifying abnormalities in chambers, valves, or wall motion. An ECG can determine current electrical activity and can identify issues such as arrhythmias (e.g., ventricular tachycardia, atrial fibrillation, sinus-node arrhythmia, heart blockage), ischemia, and other cardiac dysfunction. Prior myocardial infarction and ischemia will also show up on ECG tracings through altered QRS complexes and inverted P waves.

LINK TO LEARNING

Review common cardiac diseases (https://openstax.org/r/77CardiacDiseas) to learn more about the types of cardiovascular diseases.

Other diagnostic tests identify various types of heart dysfunction including partial or complete blockage, congenital heart disease, peripheral vascular disease, and risk factors for stroke. Such tests include the following:

- Stress test: The patient is placed on a treadmill to evaluate heart function during physical stress, uncovering abnormalities that may not be apparent at rest. A chemical stress test, or the use of medication to simulate the patient's heart response to exercise, may be used to replace a treadmill stress test if the patient is unable to perform a regular stress test.
- Tilt table test: The patient is connected to an ECG and blood pressure monitor and is strapped to a table that tilts the patient from a lying to standing position. This test is used to determine if the patient is likely to have sudden drops in blood pressure (orthostatic hypotension) while standing, or slow pulse rates with position changes. This test might be performed if the patient is experiencing frequent fainting spells.
- Electrophysiology study: For this test, insulated electric catheters are placed through the femoral vein and threaded into the heart. It is used to test the heart's electrical system. It helps healthcare providers identify causes of abnormal heart rhythms.
- Cardiac catheterization (coronary angiogram): During this test, a small catheter is guided through the femoral artery, or sometimes the wrist or arm, into the patient's heart. Dye is injected through the catheter, and fluoroscopy (continuous x-rays) are taken as the dye travels through the heart arteries and heart chambers. This comprehensive test shows narrowing in the arteries, heart chamber size, heart pump efficiency, and the efficiency of valves opening and closing. It also measures the pressures within the heart chambers, arteries,

and veins. This invasive procedure visualizes coronary arteries and identifies blockages or abnormalities.

- Cardiac MRI: This procedure uses a combination of large magnets, radiofrequencies, and a computer to make detailed images of organs and structures in the body. An MRI of the heart may be ordered to assess the heart valves and major vessels. It can also detect coronary artery disease and resultant damage caused. Tumors and congenital heart conditions can also be evaluated.
- Cardiac MRA: This is a special type of MRI procedure used to evaluate blood vessels in the heart. Contrast dye is used to help highlight blood flow.
- Cardiac CT scan: This imaging procedure uses X-rays and a computer to create a 3-dimensional images of the heart. Sometimes dye is injected into a vein so that the heart arteries can be seen as they uptake the dye. Sometimes medicine is administered to lower the patient's heart rate so it captures a better image. A CT scan can also be used to find out how much calcium is in the heart arteries. Calcium is a marker for coronary artery disease.

LINK TO LEARNING

Read how one nurse's myocardial infarction affected how she educates patients on heart health (https://openstax.org/r/77NurseMyocInfa) and teaches patients to listen to their bodies.

Identifying Abnormalities in Findings

Typically, diagnosing a heart problem involves a combination of blood tests, heart monitoring, and imaging studies. Recognizing normal and abnormal results is instrumental in quality and safe patient care. Based on diagnostic test findings, the nurse must adapt the care plan according to the patient's needs as well as when providing instructions and orders. In scenarios where abnormalities in cardiovascular findings are identified, the nurse plays a critical role in further assessment, communication, and collaboration with the healthcare team. The following examples help define what the nurse may do in these situations:

- Immediate Response: If the abnormalities indicate a critical condition (e.g., severe arrhythmias, acute myocardial infarction), the nurse initiates emergency response protocols. The immediate goals are to ensure the patient's safety, administer appropriate interventions, and call for assistance if needed.
- Communication: The nurse must communicate findings promptly to the healthcare team, including the primary care provider, cardiologist, or other specialists. Reporting critical values and changes in the patient's condition helps ensure swift decision-making.
- Patient monitoring: Simultaneously, the nurse is continuously monitoring the patient's vital signs and cardiac parameters to track any dynamic changes. Implementing continuous cardiac monitoring is crucial for patients at risk of arrhythmias or other acute events.
- Symptom management: The nurse is responsible for assisting with pain management and providing comfort measures. Administering medications as prescribed for symptom relief or to address acute issues is one of the first steps. Nitroglycerin, initially sublingual and then intravenously, is one option because it provides vasodilation, which helps oxygenate cardiac muscle, thus easing chest pain. The sympathetic nervous system's response to cardiac pain causes or worsens lightheadedness, weakness, diaphoresis, and palpitations. This, in turn, increases cardiac workload. Therefore, another cardiac pain management option is morphine, which helps to mitigate the sympathetic nervous system response.
- Collaboration: Treating CVD is a collaborative effort of healthcare professionals in many disciplines. In addition to nurses, physicians, respiratory therapists, pharmacists, and radiology technicians are needed to provide comprehensive care. Nurses work closely with the interdisciplinary team to create and implement a tailored care plan.
- Education: Nurses play a pivotal role in educating the patient and family members about the identified cardiovascular abnormalities, explaining the significance and potential implications. The nurse must be prepared to provide information on prescribed medications, lifestyle modifications, and follow-up care.
- Documentation: As in any healthcare situation, nurses are responsible for maintaining accurate and detailed documentation of the patient's cardiovascular assessment, interventions, and responses. The nurse must meticulously document any changes in the patient's condition and the effectiveness of interventions.

- Advocacy: Patients often feel overwhelmed and afraid when diagnosed with a CVD. Nurses are the primary advocate for the patient's needs, ensuring they receive timely and appropriate diagnostic tests, consultations, and interventions. Nurses can and should advocate for the patient to receive necessary resources and support to address the identified cardiovascular issues.
- Follow-up care: Part of advocating for the patient includes facilitating and coordinating follow-up appointments with specialists for further evaluation and management. The nurse should reinforce the importance of the patient adhering to prescribed medications and lifestyle modifications.
- Emotional support: Providing emotional support to the patient and family includes addressing concerns, fears, and questions. The nurse should encourage open communication and involve the patient in decision-making regarding their care.

UNFOLDING CASE STUDY

Unfolding Case Study #3: Part 12

Refer back to Chapter 15 General Survey, Anthropometric Measurement, and Vital Signs, Chapter 17 Nutrition Assessment, Chapter 18 Oxygenation and Perfusion, and Chapter 19 Fluids, Electrolytes, and Elimination for Unfolding Case Study Parts 1 to 11 to review the patient data. Mrs. Ramirez, a 68-year-old female, is brought to the emergency room by her husband. The patient reports shortness of breath with exertion and feeling "off" for the last three days. She has been admitted to the medical-surgical unit for observation. Assessment findings indicate she is experiencing an exacerbation of heart failure causing fluid excess. She has been given one dose of IV furosemide and reports an improvement in dyspnea. However, she just pressed the call light because she feels "like my chest is tight and feels sharp."

Nursing Notes	Patient reports chest tightness and sharp pain. Patient is mildly diaphoretic and appears anxious. S1 and S2 heart sounds present, lungs clear. Sinus tachycardia with occasional PVCs noted on the monitor.
Flow Chart	**2215: Assessment** Blood pressure: 145/82 mm Hg Heart rate: 116 beats/minute Respiratory rate: 29 breaths/minute Temperature: 99.6°F (37.5°C) Oxygen saturation: 93 percent on 2L nasal cannula Pain: 7/10 in the chest

1. Recognize cues: What patient cues are most concerning and why?
2. Analyze cues: Based on the recognized cues, what do you suspect might be happening?
3. Prioritize hypotheses: What actions do you anticipate performing for the patient based on their current presentation?
4. Generate solutions: The nurse obtains a blood sample that comes back with an elevated troponin level. What does this indicate and what should the nurse's next action be?
5. Take action: While preparing to take the patient to the cardiac catheterization laboratory, the patient asks the nurse what is going to happen there. How should the nurse respond?
6. Evaluate outcomes: The patient has just come back from the cardiac catheterization laboratory after having a stent placed in a coronary artery. What assessment findings would indicate that the procedure was successful?

Abnormalities in Cardiovascular Findings

Recognizing abnormal findings in cardiovascular health is critical for healthcare professionals in order to provide timely and effective care. Cardiovascular abnormalities can manifest through various signs and symptoms that could

have catastrophic and life-altering results. Therefore, it is of utmost importance to conduct a comprehensive assessment to identify underlying issues. One key aspect is understanding the patient's symptoms (complaints) related to potential cardiovascular problems (e.g., shortness of breath, chest pain, palpitations, dizziness, sweating, numbness, weakness). Clinical signs (e.g., edema, cyanosis, abnormal pulsations) can provide visual cues that may indicate cardiovascular issues.

In nursing practice, continuous monitoring and prompt recognition of deviations from baseline cardiovascular parameters are essential. Timely identification of abnormal findings empowers healthcare professionals to initiate appropriate interventions, collaborate with interdisciplinary teams, and guide patients toward optimal cardiovascular health outcomes. Using an algorithm for stroke assessment helps the nurse act quickly to minimize tissue injury:

Within sixty minutes of symptom onset:

- Transport to ER

Within five minutes of arrival at ER:

- Vital signs
- ECG

Within ten to twenty-five minutes of arrival at ER:

- Neurological assessment
- CT scan
- Laboratory tests
- Doppler ultrasonography (if necessary)

Within forty-five minutes of arrival at the ER:

- Administration of thrombolysis (clot buster), if eligible

Within three hours of stroke onset:

- Decision/administration of thrombolysis
- Admission to a specialized stroke unit

Continuous:

- Administration of nonglucose fluids to maintain hydration

As needed:

- Care for individual patient needs (e.g., insulin, aspirin, blood thinners, blood pressure medications, antibiotics)

Follow-up:

- Close monitoring and ongoing care for recovery

Education and awareness among healthcare providers plays a pivotal role in recognizing abnormal cardiovascular findings and delivering patient-centered care (Figure 24.27).

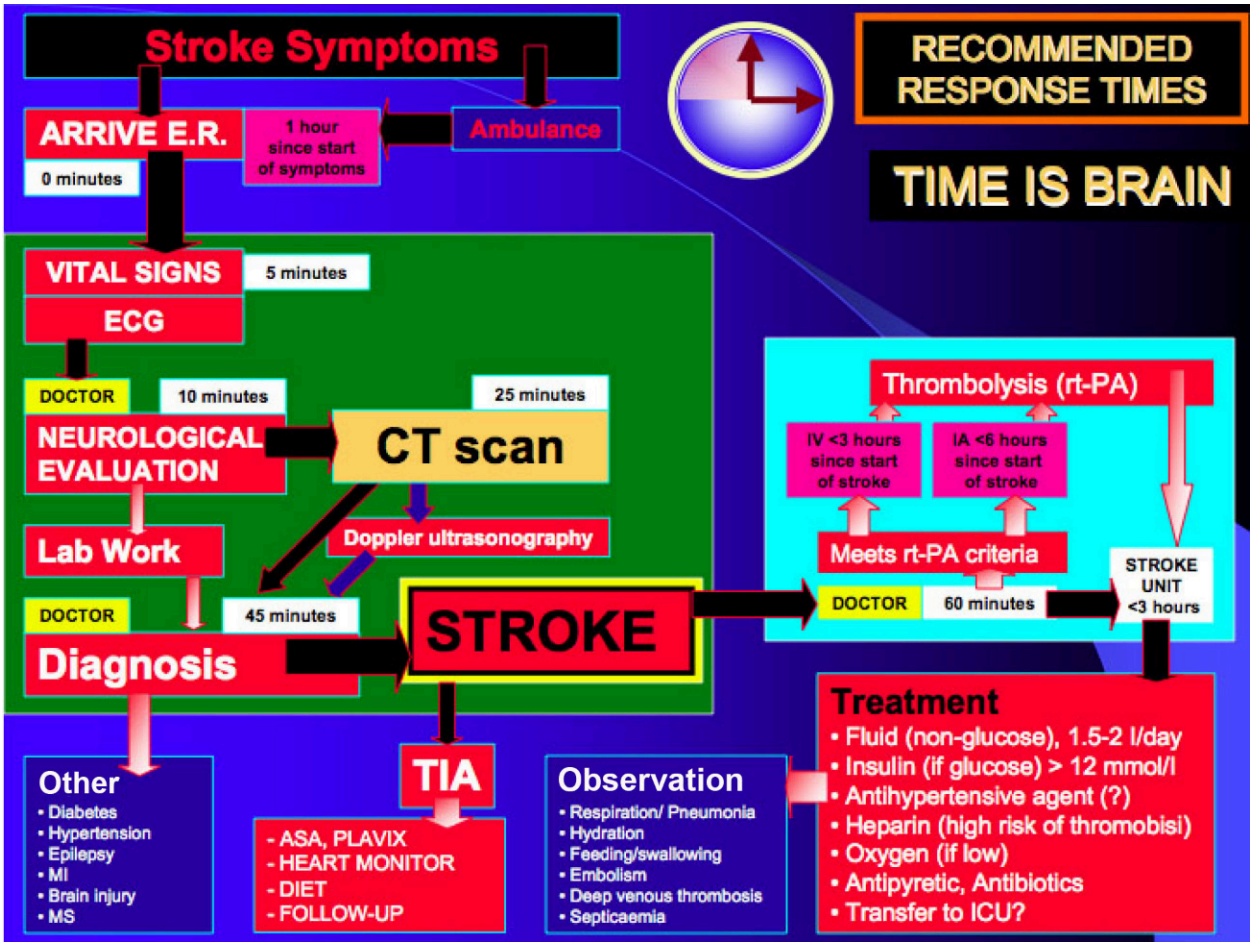


FIGURE 24.27 Identifying early signs of an ischemic attack or stroke can alert the nurse to respond quickly to help mitigate potential life-altering effects. (credit: "Stroke response times.jpg" by Webber/Wikimedia Commons; Public Domain)

Abnormalities in Peripheral Vascular Findings

Abnormal findings on peripheral examination may include edema, cellulitis, cool or warm skin, changes in the color of skin, reduced peripheral pulses, and ulcerations. Identifying these changes and how they correlate to the function of the peripheral vascular system is instrumental in creating an accurate nursing diagnosis and care plan. Venous stasis dermatitis, vasculitis, peripheral artery disease (PAD), and mixed venous and arterial insufficiency are common peripheral vascular system disorders (Table 24.10).

Disorder	Description	Signs	Treatment
Venous stasis dermatitis	Skin inflammation caused by chronic edema	• Occurs over time • Reddened and slightly warm skin, different from the tenderness seen in acute bacterial cellulitis • Commonly occurs on the lateral and medial aspects of the lower extremities, often exhibiting chronicity with cycles of healing and ulceration	• Elevation of the extremities to promote venous return • Muscular activity with gradual compression of veins • Static compression therapy using multilayer bandage wraps • Antiembolism stockings with low pressure therapy • Patient education
Vasculitis	Group of inflammatory conditions damaging the blood vessels	• Develops slowly over time or can occur quickly • Fatigue • Fever • Generalized aches and pains • Loss of appetite • Weight loss	• Over-the-counter (OTC) pain medications • Anti-inflammatory and corticosteroid treatment • Immunomodulator therapy (e.g., interleukin, interferon) • Bypass surgery may be beneficial • Patient education on the signs and symptoms of an aneurysm

TABLE 24.10 Common Peripheral Vascular System Disorders

Disorder	Description	Signs	Treatment
Peripheral artery disease	Vascular disorder demonstrated by abnormal narrowing of peripheral arteries	• Presents with calf pain and intermittent claudication • Pallor or dependent **rubor**, coolness, and ulcers, especially on the toes • Chronic tissue changes, including thinning and hairlessness, and dependent rubor (erythematous discoloration of the limbs)	• Ankle-brachial index (ABI) test to compare ankle and brachial blood pressure • Manage symptoms, smoking cessation, exercise, lipid control, and wound care • Supervised exercise to improve functional status • Antiplatelet therapy; (primarily aspirin) • Vasodilator medications to reduce pain during walking (e.g., cilostazol [Pletal]) • Patient education • Regular foot inspection
Mixed venous and arterial insufficiency	Combination of chronic venous insufficiency (CVI) and peripheral arterial occlusive disease (PAOD)	Ulceration of lower extremities, especially around ankles and feet	• Ankle-brachial index (ABI) test to compare ankle and brachial blood pressure • Revascularization surgery • Monitor for bacterial infection • OTC pain medication • Patient education on wound care

TABLE 24.10 Common Peripheral Vascular System Disorders

Summary

24.1 Cardiovascular System

The cardiovascular system is essential for maintaining continuous blood circulation and oxygen and nutrient delivery throughout the body. This intricate network of the heart, blood vessels, and blood works interdependently with other organ systems, such as the respiratory and immune systems, to sustain homeostasis. Nurses, pivotal in identifying and addressing cardiovascular issues such as hypertension and arrhythmias, must comprehend the dynamics of heart structures, assess cardiac function accurately, and intervene effectively. The myocardium's intricate muscle pattern, particularly in the left ventricle, plays a critical role in efficient pumping of blood to ensure all tissues and cells receive adequate supplies of oxygen and nutrients. Understanding the cardiac cycle and how blood flows through various vessels is integral to understanding cardiac physiology and therefore promoting optimal cardiovascular health. Nurses must be prepared to identify and understand the ECG abnormalities that may herald a variety of cardiovascular abnormalities.

24.2 Peripheral Vascular System

The peripheral vascular system consists of arteries, veins, and capillaries. This system is responsible for the transportation of oxygen, nutrients, and waste products throughout the body, which is integral to maintaining homeostasis and overall health. Nursing professionals need a comprehensive understanding of this complex network of structures for effective assessment, diagnosis, and management of various health conditions, ranging from peripheral artery disease to venous insufficiency.

Nurses must understand the functions performed by the peripheral vascular system. This allows the nurse to effectively identify early signs of vascular dysfunction and implement interventions to resolve problems. Arteries, responsible for transporting oxygenated blood away from the heart, exhibit elasticity and respond to signals for dilation or constriction, affecting blood pressure regulation. Arterioles branch from arteries and respond to the sympathetic nervous system and hormones. Veins have thinner walls and rely on muscle contraction to return deoxygenated blood to the heart.

Abnormalities in the PVS can be occlusive or functional in nature. Characteristics of arterial and venous insufficiency result in insufficient blood supply, leading to symptoms such as intermittent claudication and critical limb ischemia. Other symptoms of PVD include edema, pain and cramping, temperature changes, and skin changes. Understanding these aspects is crucial for accurate diagnosis and effective nursing care in individuals with peripheral vascular disorders.

24.3 Nursing Assessment

Assessing the cardiovascular and peripheral vascular systems for potential CVD, heart disease, and stroke is a critical component of the nursing evaluation. Nurses should collect both subjective data (from the patient) and objective findings (from the examination) to create a thorough, well-planned nursing care plan. Subjective data include the patient's medical and surgical history, social history, cardiac risk factors, symptoms, medications and other therapies, and family history to determine the potential causes and effects of CVD. Objective findings include the results of the physical examination, laboratory tests, and imaging studies. Nurses should ask clear and inquiry-based questions to clarify the patient's condition and identify any signs of dysfunction. Nurses should also follow the PQRSTU model to assess chest pain.

The various modifiable and nonmodifiable risk factors for CVD (e.g., smoking, blood pressure, cholesterol, obesity, diabetes, age, gender, genetics) should be identified and modifiable risks addressed. Validated risk assessment tools (e.g., BE-FAST, RACE, CPSS, LAMS, MEND) help nurses estimate the likelihood of stroke or heart attack and guide the treatment options. One or more of these risk assessment tools should be performed in patients who are exhibiting signs and symptoms of heart disease, stroke, and peripheral vascular disease and who have a family history of cardiovascular or peripheral vascular dysfunction.

Key Terms

absolute refractory period a time when the cell cannot respond to another stimulus
adenosine triphosphate (ATP) a nucleotide that collects chemical energy produced by the breakdown of food

molecules to provide the energy necessary for all cellular activities

arrhythmia abnormal heart rate and rhythm

arterial insufficiency insufficient arterial perfusion (blood flow to tissue) of an extremity or particular location

artery a blood vessel that carries blood away from the heart

atrial gallop an S4 sound during diastole created by the movement of blood flowing out of the atria against a stiff ventricular wall caused by hypertension, pulmonary hypertension, ventricular outflow obstruction, or ischemic heart disease; occurs immediately before the S1 and sounds like "ta-lub-dub"

auscultation the use of a stethoscope to listen for normal and abnormal sounds (e.g., components of the heartbeat, murmurs, valvular sounds, bruits)

blood-brain barrier continuous capillaries that prevent toxins from entering into the tissues of the brain

bruit a swishing sound caused by turbulence in the blood vessel and may be heard because of atherosclerotic changes

calcium ion the metabolically active portion of calcium; plays a crucial role in several physiological processes including muscle contraction (including the heart), enzyme activation, and synaptic transmission

capacitance the ability of blood vessels to hold blood at a given pressure

capillary exchange the transfer of material between capillary blood and body tissues, which is essential for delivery of nutrients and removal of waste products

capillary refill a rapid test performed on the nail beds, used for assessing the blood flow through peripheral tissues

catecholamines a hormone neurotransmitter involved in heart rate and blood pressure

clinical edema the swelling of soft tissues due to increased interstitial fluid that is outside of normal daily accumulation

continuous capillaries capillaries that are common in muscle, connective, and nervous tissues and have the lowest permeability capabilities of all capillaries

CWMS an acronym that stands for color-warmth-movement-sensation

cyanosis a bluish or dusky discoloration of the skin and mucous membranes caused by hypoxia

deep vein thrombosis (DVT) a blood clot that forms in a vein deep in the body

deoxygenated blood blood that has delivered oxygen to the tissues and picked up carbon dioxide as waste

diastole the relaxed phase of the cardiac cycle when the chambers of the heart are refilling with blood

dicrotic notch a small dip in an arterial waveform when the pressure in the ventricles becomes lower than the pressure in the pulmonary trunk and aorta, causing blood to flow back into the heart

end-systolic volume the volume of blood remaining in the left ventricle of the heart at the end of each systolic cardiac contraction

endocardium the thin, smooth membrane that lines the inside of the chambers of the heart and forms the surface of the valves

endocytosis the movement of molecules into the cell, allowing for nutrient absorption and hormone regulation as well as maintaining fluid balance

endothelium the tissue that forms a single layer of cells lining various organs and cavities of the body, especially the blood vessels, heart, and lymphatic vessels

epicardium a serous membrane that is part of the innermost layer of the pericardium and is fused to the outer surface of the heart

exocytosis the movement of molecules out of the cell to be eliminated or moved to another area of the body

fenestrated capillaries capillaries located in areas that require rapid absorption or filtration (e.g., kidneys, small intestines, brain), which provide no resistance to fluid flow across the membranes

fibrillation uncoordinated beating of the heart

formed elements cells and cell fragments suspended in the plasma. The three classes of formed elements are the erythrocytes (red blood cells), leukocytes (white blood cells), and thrombocytes (platelets)

functional blockage the widening and narrowing of vessels in response to factors such as brain signals and temperature changes, causing blood flow to be decreased with no physical damage

hydrostatic pressure the pressure of fluids against the walls of the capillaries that forces molecules, typically water, through the capillary wall

inspection visual observation of areas of the body to assess for symmetry, color, movement, swelling, and obvious alterations in body function

intermittent claudication cramp-like muscle pain, burning, or extreme fatigue in the leg that is induced by exercise and relieved by rest
isometric contraction an event occurring early in systole during which the ventricles contract while all the heart valves are closed so blood volume in the heart does not change
isovolumetric contraction an event occurring in early systole during which the pressure in the ventricles becomes high enough to push blood out, opening the valves
isovolumetric relaxation the time interval between aortic valve closure and mitral valve opening when the ventricular pressures fall below the aortic and pulmonary pressures
jugular venous distension (JVD) a bulge over the jugular vein, making it most visible on the right side of a person's neck
local signaling molecule a chemical that is released and acts on a specific area of the body
murmur a blowing or whooshing sound that signifies turbulent blood flow often caused by a valvular defect
myocardium muscles in the walls of all four chambers of the heart, though it is thicker in the ventricles and thinner in the atria
occlusive blockage a narrowing or blockage of an artery in the extremities, most often the legs, caused by inflammation, plaque buildup, or trauma to tissue, resulting in decreased blood flow
orthopnea shortness of breath that occurs while lying flat and is relieved by sitting or standing
oxygenated blood blood that has picked up oxygen in the lungs for delivery to the body
pallor the loss of color, or paleness of the skin or mucous membranes, which may be caused by reduced blood flow, oxygenation, or decreased number of red blood cells
palpation the use of the fingers or hand to assess size, consistency, texture, location, and tenderness of an organ, body part, or body area
pectus excavatum a structural deformity of the anterior chest wall that causes the sternum to be caved in or sunken into the chest; when severe, pectus excavatum can eventually adversely affect cardiac and respiratory function
percussion the tapping of the chest wall with the fingers to assess sound that may indicate an abnormality or dysfunction
pericardial friction rub a grating, to-and-fro sound or creaky-scratchy noise produced by friction of the heart against the pericardium caused by inflammation of the pericardium
pericardium the membrane or sac that surrounds and protects the heart and maintains its position in the thorax
pitting edema a visible swelling of a specific area caused by fluid buildup in the tissues, seen as indentions or "pits" in the skin when pressure is applied and the indentations remain on the skin after the pressure is released
postcapillary venules the segment of microvasculature that works in conjunction with capillaries to regulate solute exchange and respond to foreign agents (e.g., infection, inflammation)
pulmonary embolism a sudden blockage in the pulmonary arteries that send blood to the lungs
regurgitation leakage of blood backward through a valve each time the ventricle contracts
relative refractory period a time when the cell can respond but needs a stronger stimulus
rubor redness of the skin caused by inflammation
S1 the first heart sound ("lub"), which identifies the onset of systole, when the atrioventricular (AV) (mitral and tricuspid) valves close and the ventricles contract and eject the blood out of the heart
S2 the second heart sound ("dub"), which identifies the end of systole and the onset of diastole when the semilunar (pulmonic and aortic) valves close, the AV valves open, and the ventricles fill with blood
sinoatrial (SA) node an oval-shaped region of special cardiac muscle made up of pacemaker cells in the upper back wall of the right atrium
sinus rhythm the normal rhythm of the heart in which electrical stimuli are initiated in the SA node, and are then conducted through the AV node, bundle of His, bundle branches, and Purkinje fibers
sinusoid capillaries capillaries found in areas where white blood cells are formed; they have large pores to allow for movement of these cells in and out of the bloodstream (e.g., red bone marrow, liver)
spontaneous depolarization (also, prepotential depolarization) the mechanism that accounts for the autorhythmic property of cardiac muscle; also called prepotential depolarization
stroke volume (SV) the volume of blood pumped out of the left ventricle of the heart during each systolic cardiac contraction
systole contraction of the heart chambers, which pumps blood out into the vessels

transcytosis a process that allows for larger, lipid-insoluble substances to cross the capillary membrane through endocytosis and exocytosis
vein a blood vessel that returns blood to the heart
venous insufficiency a condition in which the veins in the legs do not return blood to the heart and upper body normally
ventricular ejection the central measure of ventricular systolic function, measured as ejection fraction
ventricular gallop an S3 sound that occurs after the S2 that sounds like "lub-dub-dah," or a sound similar to a horse galloping
ventricular systole the period when the ventricles contract
venules smallest veins that receive blood from the capillaries

Assessments

Review Questions

1. How would you explain the interdependency of the structures of the cardiovascular system with other organ systems?
   a. The heart and associated vessels work together with other organ systems to maintain homeostasis through oxygenation, nutritional delivery, and waste removal.
   b. The cardiovascular system filters waste from the blood and routes it to the kidneys.
   c. The heart processes nutrients from the blood and transports them to the body's tissues.
   d. The cardiovascular system coordinates with all other body systems to maintain a steady supply of red blood cells and transport them.

2. Why are the muscles of the left ventricle slightly larger than the right?
   a. The valves of the left ventricle are larger to allow more blood to flow out of the heart.
   b. The left ventricle has to generate more pressure to overcome greater resistance in the systemic circuit.
   c. The bundle branches are larger in the left ventricle compared to the right.
   d. The left ventricle must accommodate the Purkinje fibers, which trigger ventricular contraction for both sides of the heart.

3. How does the cardiovascular system work to ensure active tissues are fully supplied with oxygen and nutrients?
   a. Intralumenal valves prevent regurgitation.
   b. Skeletal muscles ensure a unidirectional flow of blood.
   c. Vessels are supported by interdependency with the muscular system.
   d. Resource allocation allows the system to supply blood to the areas most in need.

4. What is the correct sequence of the cardiac cycle?
   a. aorta, left atrium, left ventricle, right atrium, right ventricle, superior/inferior vena cavae
   b. superior/inferior vena cavae, left atrium, left ventricle, right atrium, right ventricle, aorta
   c. superior/inferior vena cavae, right atrium, right ventricle, left atrium, left ventricle, aorta
   d. aorta, right atrium, right ventricle, left atrium, left ventricle, superior/inferior vena cavae

5. What vessel transports oxygen away from the heart to the body?
   a. aorta
   b. inferior vena cava
   c. superior vena cava
   d. veins

6. What is the primary function of the peripheral vascular system?
   a. the production of red blood cells
   b. clearing of waste from the body
   c. transport of macromolecules to the cells

d. transport of oxygen-rich blood to tissues

7. A patient hospitalized following a heart attack is noted to have smooth, shiny, hairless skin on the lower extremities with no edema. What is most likely the contributing factor?
   a. arterial insufficiency
   b. carotid insufficiency
   c. venous insufficiency
   d. deep vein thrombosis

8. What characteristic is indicative of claudication associated with arterial insufficiency?
   a. pain after walking distances that is relieved with rest
   b. dull, numbing, or tingling pain in the legs during exercise
   c. pain in the upper thighs and buttocks when at rest
   d. severe pain completely prohibiting walking in individuals younger than age 50

9. When assessing a patient for critical limb ischemia, what artery will the nurse focus on when the patient reports lower calf pain?
   a. common femoral
   b. popliteal
   c. superficial femoral
   d. tibial peroneal

10. What model is used when assessing a patient complaining of pain related to a myocardial infarction?
   a. ABCDE
   b. MEND
   c. PQRSTU
   d. RACE

11. What question should the nurse ask the patient when paroxysmal nocturnal dyspnea is suspected?
   a. Do you need extra pillows to help you breathe better, or do you need to lie flat in bed to sleep?
   b. What activities elicit shortness of breath?
   c. How long does it take you to recover when you experience shortness of breath?
   d. Have you ever woken up from sleeping feeling suddenly short of breath?

12. What interpretation can be established when a patient's oxygen saturation level is read at 92 percent?
   a. This level is considered within normal limits.
   b. The patient's blood is extremely low in oxygen.
   c. The oxygen level is low, which warrants further evaluation.
   d. Carbon dioxide levels, when measured, will be elevated.

13. When inspecting the patient's neck, the nurse notices bulging on the right side. What condition can the nurse recognize in this patient?
   a. blanching
   b. edema
   c. DVT
   d. JVD

14. What will the nurse document when hearing a swishing sound during auscultation of the carotid artery?
   a. bruit
   b. friction rub
   c. rubor
   d. atrial gallop

Check Your Understanding Questions

1. Explain how the structures of the heart engage in blood flow through the cardiac cycle.
2. Describe how you will determine if a patient has either venous or arterial insufficiency.
3. Describe lymphedema and a risk factor associated with it.
4. The nurse suspects a patient experiencing symptoms of dizziness, chest pain, and shortness of breath and who reports "feeling like my heart is skipping a beat" could have a partial heart block. Explain what testing the nurse may anticipate to confirm or rule out this dysfunction?

Reflection Questions

1. While caring for a patient with reduced perfusion to the lower extremities, you recognize that you are uncertain if the patient is experiencing a blood-clotting issue or a cardiac-cycle issue. What steps will you take to find the answer?
2. How does understanding the cardiac cycle help you as a nurse?
3. When assessing a patient for peripheral vascular disease, how will you determine which structures (vessels) are affected?
4. Reflect on the steps of auscultating heart sounds and what sounds the nurse should anticipate when assessing for inflammation of the pericardium?

Critical-Thinking Questions about Case Studies

1. Refer to Unfolding Case Study #3: Part 12.
   When the nurse is performing a focused cardiovascular assessment, what should the nurse assess during the "inspection" portion of the assessment?

What Should the Nurse Do?

1. The nurse walks in and finds a patient leaning over on the bed. When asked, the patient reports trying to get up and use the restroom but suddenly felt dizzy and lightheaded. The nurse assists the patient back into bed and measures the patient's vitals, which were BP: 98/64 mm Hg and pulse 54. What should the nurse do for this patient?
2. During an assessment of a patient who is two-day postoperative, the nurse notes cyanosis in the patient's left hand. Based on this finding, what action should the nurse take next?
3. A 68-year-old male and his wife present at their primary care physician's (PCP) office. The man has a history of diabetes and peripheral vascular disease. He is complaining of new pain in both legs. The nurse completes an assessment and relevant findings, including blood pressure of 148/92, no pitting edema bilaterally, and the skin of his legs and feet is cold, clammy, shiny, and thin. The patient describes pain of 5/10 when walking that is relieved within ten minutes at rest. What does the nurse believe is occurring and what should the nurse instruct the patient to do for the pain?
4. What cardiac diagnostic tests will the nurse analyze in an effort to create an effective nursing care plan for a patient?

Competency-Based Assessments

1. Role-play as a nursing school instructor with a peer who plays the role of student. As the instructor, teach the student why it is important to know the components of blood.
2. Role-play with a peer to enact a discussion with a patient who is suspected to have Buerger disease.
3. Demonstrate the appropriate technique for performing auscultation of heart sounds.
4. Create a video that demonstrates performing an assessment of a patient with a history of hypertension, diabetes, and peripheral vascular disease. Also, discuss relevant consults and initial treatment options.

5. Make a video of the appropriate technique for collecting both subjective and objective data from a patient who presents in the emergency department with reports of chest pain, dizziness, and nausea.

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CHAPTER 25
Assessment of the Musculoskeletal System

FIGURE 25.1 A comprehensive musculoskeletal assessment can identify a patient's ability to perform daily activities of living. (credit: modification of work "Physical therapy" by SrA Jeff Parkinson/Air Force Medical Service, Public Domain)

CHAPTER OUTLINE

25.1 Structure and Function
25.2 Physical Assessment
25.3 Recognizing Common Musculoskeletal Disorders

INTRODUCTION The human musculoskeletal system is composed of muscles, bones, and joints, and is most recognized for the framework and shape of the body. This system offers the ability to stand upright and to move. Protection is another factor offered by the musculoskeletal system, as critical organs and structures like the heart and lungs are enclosed within the thoracic cage, the brain inside the skull, and the spinal cord sheathed within the vertebral column. Hematopoiesis, or production of red and white blood cells and platelets, is another function of the musculoskeletal system. It is within the bone marrow where the production of these cells occurs. And finally, this body system supplies certain minerals as needed, as bones are the primary storage facility for the electrolytes calcium and phosphorous.

While diagnosis of musculoskeletal problems—injuries and disease processes—is within the realm of diagnosticians—physicians, nurse practitioners, and physician's assistants, generalist nurses are expected to assess the musculoskeletal system and to recognize normal versus abnormal findings. As with other body systems, abnormal assessment results should be brought to the attention of the advanced practitioner for further diagnostic testing, a definitive diagnosis, and creation of the treatment plan.

There are problems that plague the musculoskeletal system in a variety of ways. Fractures, for example, may be problematic at any age, especially in consideration of traumatic accident or injury. Certain issues arise from birth and may be either congenital or have a genetic component; childbirth itself may lead to compression injuries or

fractures of the skeletal system or certain muscles. The aging process impacts musculoskeletal structures, as degenerative changes cause deterioration of bones or atrophy of muscles. Generalist nurses are expected to use clinical judgment to assess and act on common musculoskeletal disorders and, once again, refer such patients, as well as those with unusual, rare conditions, to diagnosticians for diagnosis and treatment planning.

25.1 Structure and Function

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify structures of the musculoskeletal system
- Recognize functions of the musculoskeletal system
- Recall effects of impaired function of the musculoskeletal system

The normal musculoskeletal configuration in individuals allows for normal posture and mobility. Abnormalities, such as genetic, congenital, or as a result from disease or injury, can have effects on musculoskeletal structure and function. Wherever the system is functionally impacted, alterations from normal abilities may be noticed by the affected patient and assessed by healthcare personnel, including postural or mobility variations, traumatic injuries, electrolyte imbalances, or hematologic abnormalities.

An assessment of the musculoskeletal system includes collecting data regarding the structure and movement of the body as well the patient's mobility. This unit provides an overview of the structure and function of the musculoskeletal system and explores the effects of impaired function.

Structures of the Musculoskeletal System

The **musculoskeletal system** gives us the ability to move. It is composed of bones, muscles, joints, tendons, ligaments, and cartilage that support the body, allow movement, and protect vital organs (Figure 25.2). The next sections review the anatomy of the musculoskeletal system, including the skeleton, skeletal muscles, tendons, and joints.

FIGURE 25.2 Bones, muscles, joints, tendons, ligaments, and cartilage interact in various ways to comprise the musculoskeletal system. (credit: "Skeleton and muscles.png" by Ryan Hoyme/Wikimedia Commons, Public Domain)

Skeleton

The skeleton is composed of 206 bones that provide the internal supporting structure of the body (Figure 25.3). The **bone**, or **osseous tissue**, is a hard, dense connective tissue that forms most of the adult skeleton, the support structure of the body. In the areas of the skeleton where bones move (e.g., the rib cage and joints), **cartilage**, a semirigid form of connective tissue, provides flexibility and smooth surfaces for movement. The **skeletal system** is the body system composed of bones and cartilage and performs the following critical functions for the human body:

- supports the body
- facilitates movement
- protects internal organs
- produces blood cells
- stores and releases minerals and fat

The bones of the lower limbs are adapted for weight-bearing support, stability, and walking. The upper limbs are highly mobile with a large range of movements, along with the ability to easily manipulate objects with our hands and opposable thumbs.

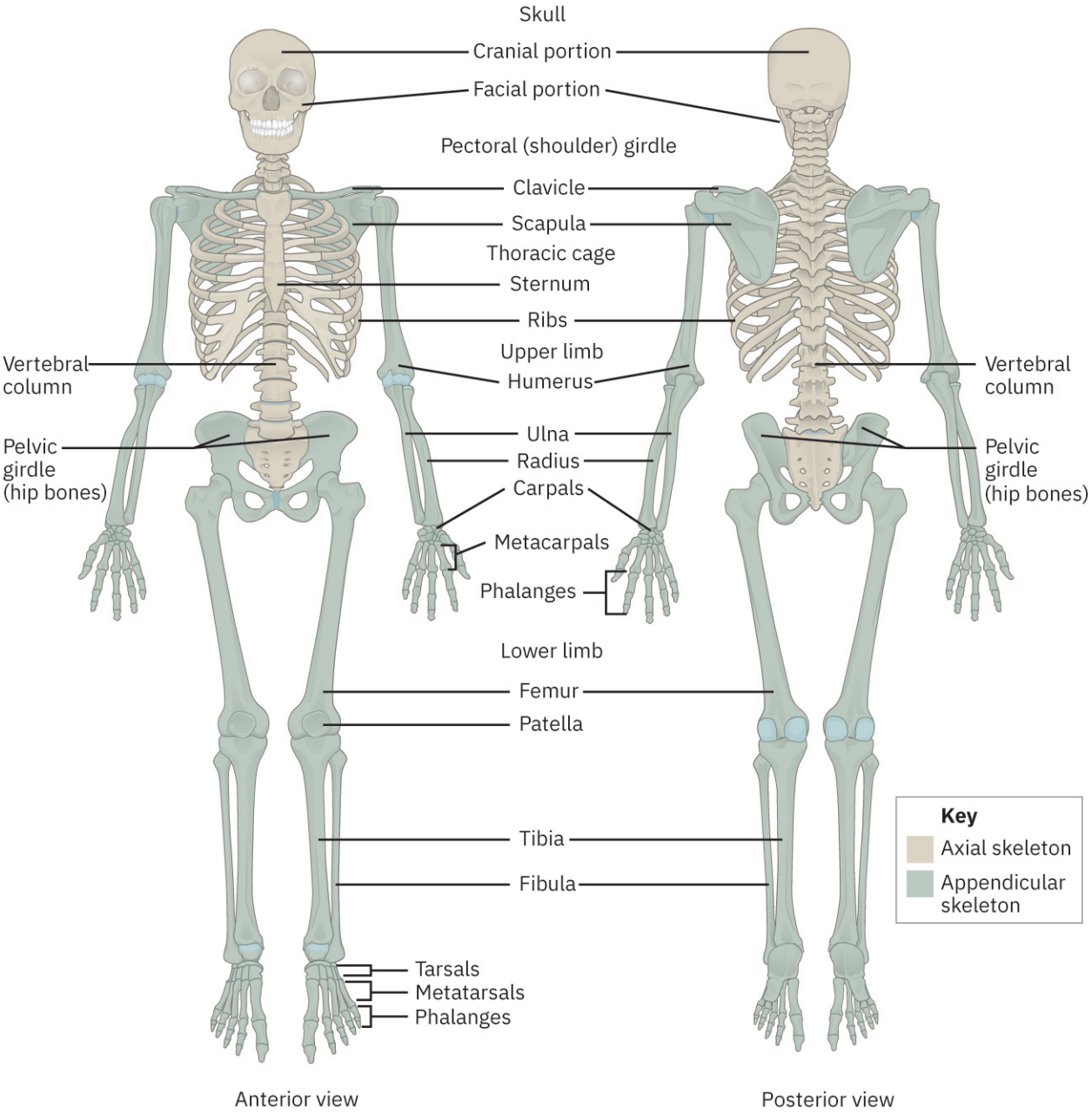


FIGURE 25.3 These are anterior and posterior views of the major bones in the body. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

It may appear that bones are static, but bone undergoes ossification and resorption throughout the life span. In the early stages of embryonic development, the embryo's skeleton consists of fibrous membranes and hyaline cartilage. By the sixth or seventh week of embryonic life, the actual process of bone development, or **ossification,** begins. Bone development continues until about the age of 25 years (Breeland et al., 2023). The three types of cells involved are osteoblasts, osteocytes, and osteoclasts. Osteoblasts are immature bone cells and primarily produce collagen. Osteocytes are mature cells and facilitate new bone development. On the other hand, bones are remodeled by osteoclasts as they resorb or remove existing bone (Figure 25.4). In normal circumstances, this ossification-resorption process is in an appropriate balance; there are situations where this equilibrium is lost, and for example, bone loss becomes excessive—this is explored later in the chapter.

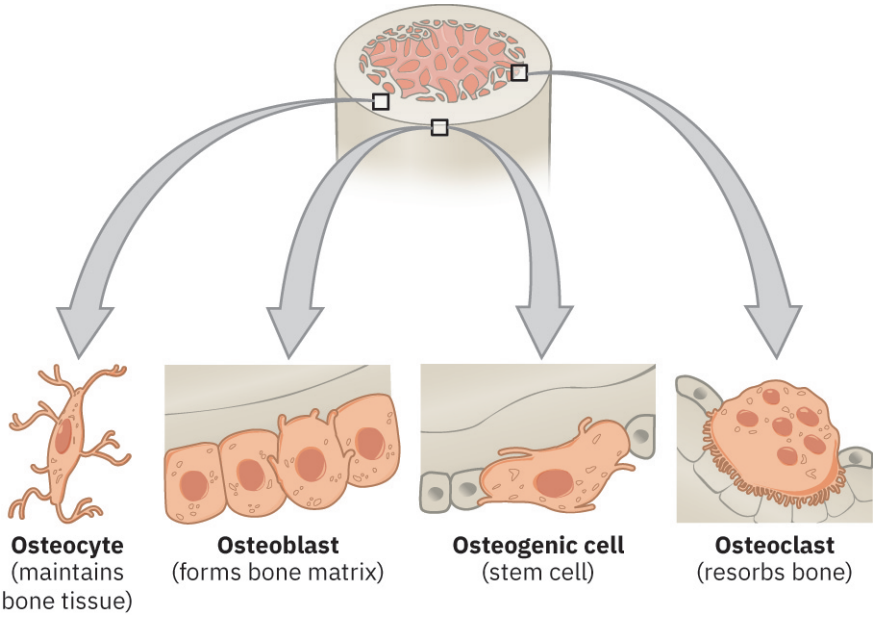
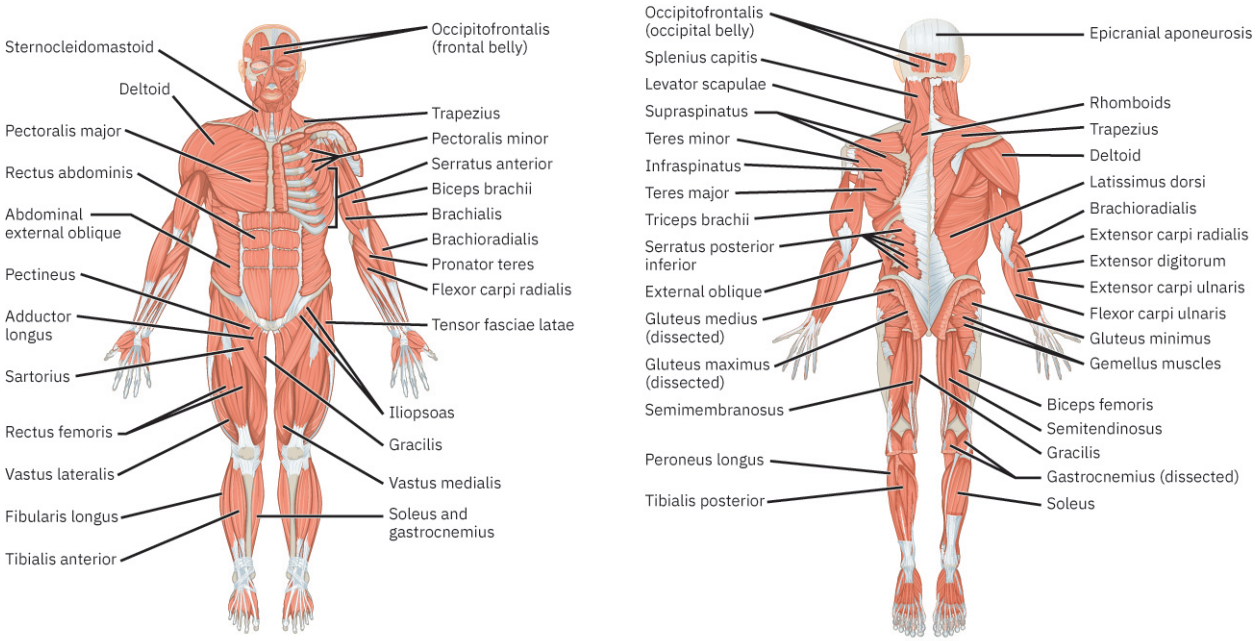


FIGURE 25.4 An osteogenic cell is the stem cell for bone. Osteoblasts are responsible for starting the process of new bone development by the creation of collagen. Osteocytes are the mature form of bone cell and facilitate creation of new bone. Osteoclasts resorb existing bone. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

A **ligament** is a band of tissue that connect bones to one another, provide support and stability, and enhance joint movements. While bones are well supplied with blood, which supplies oxygen and other nutrients, ligaments are not well perfused which makes for a slower healing process for injured ligaments.

Skeletal Muscles

There are three types of muscle tissue: skeletal muscle, cardiac muscle, and smooth muscle. The **skeletal muscle** produces movement, assists in maintaining posture, protects internal organs, and generates body heat (Figure 25.5). Skeletal muscles are voluntary, meaning a person is able to consciously control them, but they also depend on signals from the nervous system to work properly. Other types of muscles are involuntary and are controlled by the autonomic nervous system, such as the smooth muscle within our bronchioles.



Major muscles of the body.
Right side: superficial; left side: deep (anterior view)

Major muscles of the body.
Right side: superficial; left side: deep (posterior view)

FIGURE 25.5 These are anterior and posterior views of major skeletal muscles of the body. (credit: modification of work from *Anatomy and*

Physiology 2e. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

To move the skeleton, the tension created by the contraction of the skeletal muscles is transferred to the tendons, strong bands of dense, regular connective tissue that connect muscles to bones.

LINK TO LEARNING

This short video illustrates how bones move muscles (https://openstax.org/r/77bonemove) by the interaction of signals from the neurological system and the contraction of muscle fibers.

Tendons

A **tendon** is a band of fibrous collagenous tissue that provide a continuation of the muscle sheath to enable muscle attachment to the periosteum of bones (Figure 25.6). Tendons are both flexible and strong, and they enable movement by pulling the bone upon muscle contraction, using a lever action. Tendons also provide some shock absorption, as they take up some of the muscle impact associated with certain activities, such as jumping. The tensile strength of tendons provides resistance to injury, but certain events (e.g., traumatic injury, fluoroquinolone antibiotics) may cause tendon damage or rupture. Similar to ligaments, tendons are not perfused as efficiently as some tissues, so healing after a tendon is injured is a slow process.

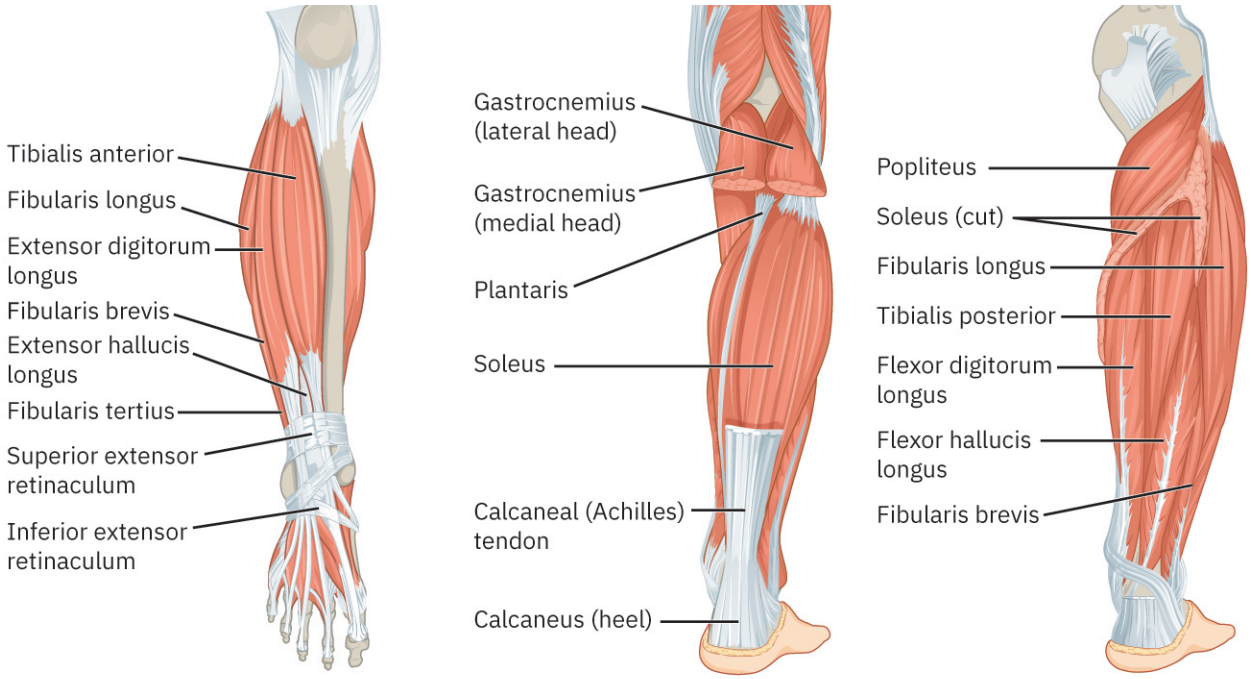


FIGURE 25.6 The lower leg provides an example of the interaction of muscles, tendons, and ligaments, and how they interact with skeletal structure. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Joints

A **joint** is a location where bones come together. Many joints allow for movement between the bones (Figure 25.7). Synovial joints are the most common type of joint in the body. A **synovial joint** has a fluid-filled joint cavity where the articulating surfaces of the bones contact and move smoothly against each other.

The **articular cartilage** is smooth, white tissue that covers the ends of bones where they come together and allows the bones to glide over each other with very little friction. Articular cartilage can be damaged by injury or normal wear and tear. Lining the inner surface of the articular capsule is a thin synovial membrane. The cells of this membrane secrete **synovial fluid**, a thick, slimy fluid that provides lubrication to further reduce friction between the bones of the joint.

Some joints are relatively immobile but stable. Other joints have more freedom of movement but are at greater risk of injury. For example, the hinge joint of the knee allows flexion and extension, whereas the ball-and-socket joint of the hip and shoulder allows flexion, extension, abduction, adduction, and rotation. The knee, hip, and shoulder joints are commonly injured and commonly seen in clinical settings.

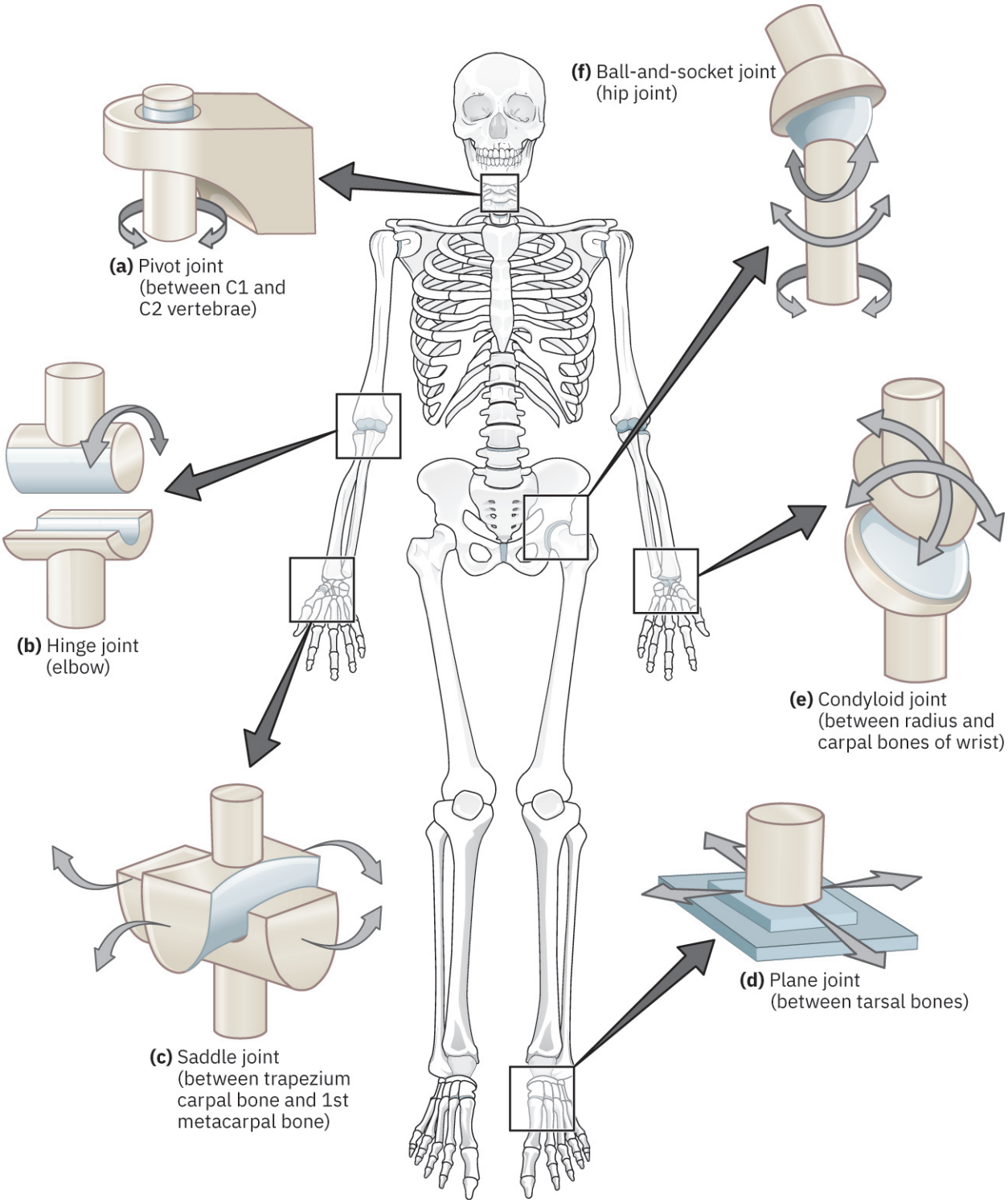


FIGURE 25.7 The six types of joints in the human body are the pivot, hinge, saddle, plane, condyloid, and ball-and-socket joints. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Functions of the Musculoskeletal System

The musculoskeletal system has five main functions:

- support the body
- facilitate movement
- protect internal organs
- produce blood cells
- store and release minerals and fat

These functions adjust throughout the life span, according to the body's needs.

Support, Movement, and Protection

Just as the steel beams of a building provide a scaffold to support its weight, the bones and cartilage of your skeletal system compose the scaffold that supports the rest of your body. Without the skeletal system, you would be a limp mass of organs, muscle, and skin. Bones also facilitate movement by serving as points of attachment for your muscles. While some bones only serve as a support for the muscles, others also transmit the forces produced when your muscles contract. From a mechanical point of view, bones act as levers, and joints serve as hinges.

Bones also protect internal organs from injury by covering or surrounding them. For example, your ribs protect your lungs and heart, the bones of your vertebral column (spine) protect your spinal cord, and the bones of your cranium (skull) protect your brain (Figure 25.8).

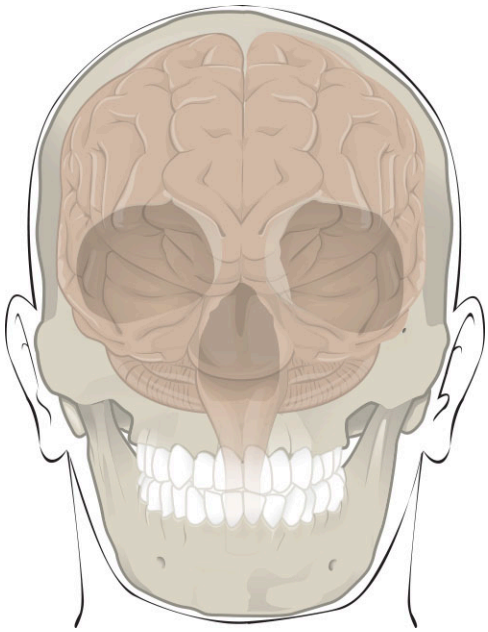


FIGURE 25.8 The cranium provides protection to the brain. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Mineral Storage, Energy Storage, and Hematopoiesis

The most apparent functions of the skeletal system are the gross functions—those visible by observation. Simply by looking at a person, you can see how the bones support, facilitate movement, and protect the human body. On a metabolic level, bone tissue performs several critical functions. For one, the bone matrix acts as a reservoir for a number of minerals important to the functioning of the body, especially calcium and phosphorus. These minerals, incorporated into bone tissue, can be released back into the bloodstream to maintain levels needed to support physiological processes. Calcium ions, for example, are essential for muscle contractions and controlling the flow of other ions involved in the transmission of nerve impulses.

Bone also serves as a site for fat storage and blood cell production. The softer connective tissue that fills the interior of most bone is referred to as **bone marrow**. There are two types of bone marrow: yellow marrow and red marrow (Figure 25.9). The **yellow marrow** contains adipose tissue; the triglycerides stored in the adipocytes of the tissue can serve as a source of energy. The **red marrow** is where **hematopoiesis**—the production of blood cells—takes place. Red blood cells, white blood cells, and platelets are all produced in the red marrow. For example, a child who has a history of bleeding, bruising, and fatigue might be tested for a bone marrow disorder.

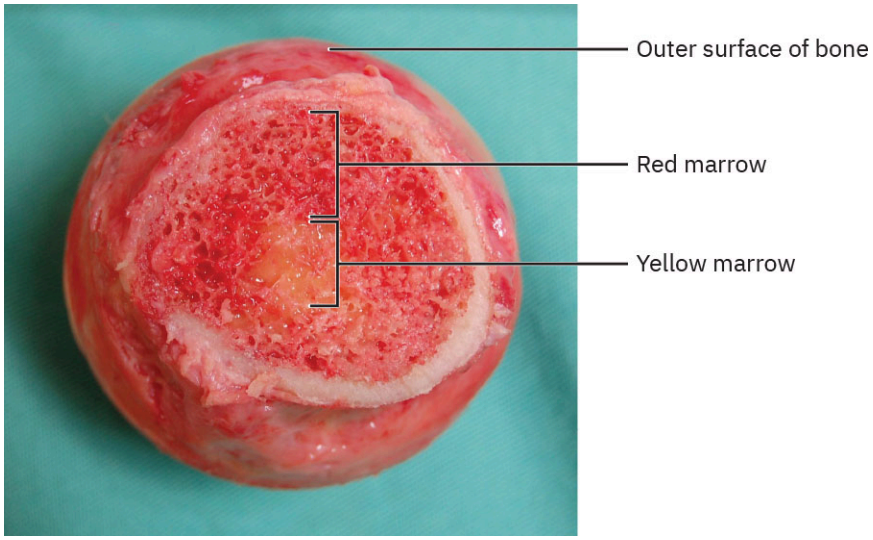


FIGURE 25.9 The head of the femur contains both yellow and red marrow. Yellow marrow stores fat, and red marrow is responsible for hematopoiesis. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LINK TO LEARNING

This video provides an overview of the structure and function of bones and muscles (https://openstax.org/r/77bonestruc) as well as a selection of some of the abnormalities affecting the musculoskeletal system.

Effects of Impaired Function of the Musculoskeletal System

There are approximately 150 different diseases and conditions that affect the musculoskeletal system, and about 1.71 billion people have musculoskeletal conditions worldwide (World Health Organization [WHO], 2022). These conditions are the leading cause of disability (WHO, 2022). Changes to the musculoskeletal system can have physical and psychological effects on a person.

Physical Effects

The musculoskeletal system is susceptible to an array of causes for variance from normal function. Based on the normal functions of the system, the impact on the body is somewhat predictable, considering which aspect of the system is not functioning properly. Physical effects commonly include the following:

- Inflammation: Illness and injury initiate the inflammatory processes. Five classic signs include pain, heat, redness, swelling, and loss of function.
- Pain (acute, chronic, or acute-on-chronic): Pain is the result of several possible musculoskeletal disorders.
- Limited dexterity and decreased mobility: Agility, strength, and movement can be limited by many factors.
- Electrolyte abnormalities: Calcium and phosphorous are stored in skeletal structures; imbalances can affect other electrolytes and overall health status.
- Impaired blood cell production: Altered bone marrow function potentially affects production of blood cells.
- Weakness and fatigue: Lack of energy and strength can result from different sources associated with musculoskeletal function and malfunction.
- Limitations in completing activities of daily living (ADLs): Malfunctions of normal function can impact ADLs in many ways.

REAL RN STORIES

Inflammation and Immunity

Nurse: Margaret, RN

Clinical setting: Intensive care unit
Years in practice: 5
Facility location: Aurora, Colorado

The patient was in his midtwenties; he was a rancher and had been on a tractor when it overturned, tossing him and then landing on top of him. Surprisingly, his musculoskeletal injuries were minor, considering a tractor had toppled onto him: a couple of rib fractures and some scrapes and abrasions. Why were his injuries not worse? When he fell off the tractor, and it ended up over him, he was lying in a pile of manure, which is soft and allowed him to be pushed further down, rather than on a hard surface where any resistance would have had to come from his own body.

However, lying in a pile of manure is not without risks. After all, it is full of bacteria, and he had several open wounds, so the risk for challenges to his immune system were huge. As his nurses, we had to be vigilant for signs of immune response to infection, which were likely to manifest through inflammatory reactions. We assessed him frequently, looking for new developments in the classic signs of inflammation. He was already experiencing loss of function—he had been intubated to address oxygenation issues brought on by the broken ribs, and we monitored for any changes indicating worsening in oxygenation and perfusion. And for the likely source of infection, we watched his wounds—marking regions of swelling and redness in order to identify any advancement of the processes, palpating for local warmth, and watching his face as we touched him, for responses likely to result from pain.

Such vigilance paid off: rising oxygen needs, diminished pedal pulses, falling blood pressure, and spikes in temperature and heart rate alerted us quickly to sepsis. The providers were promptly notified as changes occurred, and orders were thorough to address and support his body through the various physiological reactions involved in a systemic and potentially deadly cascade of events. He survived, and after a lengthy hospital course was transferred to a rehabilitation facility to regain lost muscle strength; after several months, he was discharged back to his ranch.

Any deviation from normal in the intricate functions of the musculoskeletal system can cause significant effects. As presented, traumatic injury, degenerative changes, hematologic changes, and autoimmune disorders are all possible contributors. The subsequent consequences are not limited to physical but often also involve psychological effects.

Psychological Effects

As previously established, musculoskeletal disorders can impact patients through physical deformities or functional changes, and one of the most common issues is pain. Psychological effects of musculoskeletal problems frequently include the following:

- Pain (acute, chronic, or acute-on-chronic): Pain can be the result of many musculoskeletal disorders.
- Reduced participation in activities: This may include the following:
  - Society/group events: church attendance, social affairs, shopping, travel
  - Employment: may miss work, or need to retire early for psychophysiological reasons
- Weakness: This can be a consequence of several musculoskeletal disorders.
- Anxiety and/or depression: This may be experienced relative to pain and worry about pending procedures, potential missed time at work, or job loss and family strain (Garnæs et al., 2022).
- Insomnia: Sleep can be impacted by many factors, including discomfort or pain, anxiety, or depression (Garnæs et al., 2022).

PATIENT CONVERSATIONS

A Patient Anticipating Total Knee Arthroplasty

Scenario: Mr. Adams is scheduled for total knee arthroplasty in a week and is meeting with the orthopedic nurse for preoperative assessment and education. The nurse, Albert, is conscientious about describing key factors of the Enhanced Recovery After Surgery protocol followed by the hospital where Mr. Adams's will have the surgery. Mr. Adams is wringing his hands and tapping one foot rapidly on the floor.

Nurse: Mr. Adams, I want to go over some things to expect after your knee operation next week. But first, do you have any questions?

Patient: It's not really a question. I'm really nervous about this operation. I'm afraid I'll get hooked on pain medicine. But I know it's going to hurt, what with having my knee cut up.

Nurse: I can see you're anxious. Let's see if I can help you be more comfortable about this. Since you're worrying about addiction, I'll start with that. You're right that right after the surgery, you can expect pain, and pain medicine usually includes what we call, "opioids, or narcotics." While these are drugs that can cause addiction, when you need them, like for the first few days after an operation, and you take them correctly, the chances of becoming addicted are minimal.

Patient: But you see on TV, there are so many addicts in the world. They won't give me fentanyl, will they?

Nurse: Your team of doctors usually uses a nerve block, which will keep pain under control for the first day or so. This helps you need less pain medicine through your IV, or as a pill. Your nurses will also ask you how your pain is at least every hour, but you can push your call button, and let them know if it gets worse before that, or you need something else. Again, if you take the pain medicine as your doctor prescribes, it is very unlikely to become addicted. It is common to only need a few days of opioids, and you can probably successfully switch to an anti-inflammatory drug like ibuprofen on day three. Maybe just taking the opioid at bedtime for another day or two.

Patient: What about the fentanyl? So much is on the news about there being so many overdoses.

Nurse: Many people worry about this, but that is not the same fentanyl used in the hospital. It is made in questionable ways and places. If you're given fentanyl, it is made carefully in a laboratory and is as safe as other pain medicines like morphine or Dilaudid. The nurses will also be sure you have ice packs to help with the pain and swelling.

Patient: Oh good, I get so worried about things on the news.

Nurse: That's one of the reasons for an appointment like this, Mr. Adams.

Scenario follow-up: Albert continues patient education, with more details about how to take pain medicine to keep pain under control. He also reviews recommendations for correct positioning of the operative leg after surgery, and how important it is to ambulate, starting on the same day of the surgery, barring any complications. Albert is careful to include opportunities for Mr. Adams to ask questions and vent his fears and worries. Before completing the appointment, the nurse has Mr. Adams demonstrate understanding the information by teaching the key points to Albert. He is given written information to review.

The psychological effects can become pervasive and invade other aspects of patients' lives, causing recurrent emotional signs and symptoms. As conditions become more complicated, it can be more difficult to identify the root of the problem and appropriately treat the multiple factors involved. Even medication therapies bring complexity as each drug prescribed or recommended brings its own desired and potentially undesired results.

25.2 Physical Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Analyze how to perform a comprehensive musculoskeletal assessment
- Explain abnormalities identified during the assessment of the musculoskeletal system
- Recall proper documentation of musculoskeletal assessment

Nurses are responsible for different types of assessments, based on the circumstances and the patient's status. A complete assessment is typical as part of an annual physical examination or on admission to the hospital. Nurses also perform such thorough head-to-toe assessments at the beginning of a shift—to establish baseline or compare to the previous nurse's findings. During a shift, assessments tend to focus on a particular body system or a couple of related systems, because it is rare for one organ system to function in isolation. Focused assessments tend to be more quickly accomplished and can be broadened in scope if abnormal findings are identified.

An assessment of the musculoskeletal system is an example of such an assessment. As part of clinical judgment and vigilant professional nursing practice, the nurse demonstrates awareness of the relationship of musculoskeletal structure and function with other organs and body systems and explores any abnormal or unusual findings or

concerns the patient expresses.

Comprehensive Musculoskeletal Assessment

A patient's mobility status and their need for assistance affect nursing care decisions, such as handling and transferring procedures, ambulation, and implementation of fall precautions. Initial mobility assessments are typically performed by a physical therapist (PT) on admission to a facility. Specific limitations are prescribed by the healthcare provider during the admission process, patient care rounds, or after a procedure or surgery. Specific facility and unit policies and procedures also provide guidelines as to frequency of assessments and changes for which prescriber notification is indicated. Nursing assessment of the musculoskeletal patient should include pain assessment, before and after administration of pain medication and/or nonpharmacological interventions, as well as frequent circulatory, motor, and sensation (CMS) assessment of the affected region(s).

Prescriptions for activity by the healthcare provider or PT may indicate total bed rest, authorization for getting out of bed to use a bedside commode, or more freedom. Patients with lower extremity fractures or those recovering from knee or hip replacement often progress through stages of weight-bearing activity (Table 25.1).

Type of Weight-Bearing	Description
Non-weight-bearing	• The affected leg must not touch the floor and is not permitted to support any weight. • Crutches or other devices are used for mobility.
Toe-touch weight-bearing (TTWB)	• The foot or toes may touch the floor to maintain balance only. • No weight should be placed on the affected leg.
Partial weight-bearing	• A small amount of weight may be supported on the affected leg, with gradual increase to 50 percent of body weight. • Permits the person to stand with body weight evenly supported by both feet. • No walking.
Weight-bearing as tolerated	• Patient can support 50 to 100 percent of weight on the affected leg. • Patient can independently choose the weight supported by the extremity based on their tolerance and the circumstances.
Full weight-bearing	• Affected leg can support 100 percent of a person's body weight. • Walking is permitted.

TABLE 25.1 Weight-Bearing Prescriptions

Assistance levels, from the need for full support to independence, are exemplified in Table 25.2.

Assistance Type Required	Description
Dependent	• Patient is unable to help at all. • Mechanical lift and/or assistance by other personnel is required to perform tasks.
Maximum assistance	• Patient can perform 25 percent of the mobility task with caregiver assistance of 75 percent.
Moderate assistance	• Patient can perform 50 percent of the mobility task with caregiver assistance of 50 percent.
Minimal assistance	• Patient can perform 75 percent of the mobility task with caregiver assistance of 25 percent.
Contact guard assist	• Patient can perform the mobility task with caregiver assistance with balance, by placing one or two hands on the patient's body.
Stand-by assist	• Patient can perform the mobility task without hands-on assistance. • Caregiver remains close to the patient for safety in case they lose their balance or need help during performance of the task.
Independent	• Patient can safely perform the functional task on their own; assistance is not needed.

TABLE 25.2 Types of Mobility Assistance Needs

In addition to reviewing orders regarding weight-bearing and assistance required, all staff should assess patient mobility before and during interventions, such as transferring from surface to surface or during ambulation. To perform a comprehensive musculoskeletal assessment, the nurse focuses on obtaining focused subjective and objective data.

Subjective Data

Collect subjective data from the patient and pay particular attention to what the patient is reporting about current symptoms as well as past history of musculoskeletal injuries and disease. Information during the subjective assessment should be compared to expectations for the patient's age group or that patient's baseline. For example, an older client may have chronic limited range of motion (ROM) in the knee due to osteoarthritis, whereas a child may have new, limited ROM due to a knee sprain that occurred during a sports activity.

If the patient reports a current symptom, use the PQRSTU method to obtain more information about this chief complaint (Table 25.3).

PQRSTU	Questions
Provocation/palliation	What makes your pain worse? What makes your pain feel better?
Quality	What does your pain feel like?

TABLE 25.3 Sample PQRSTU Focused Questions

PQRSTU	Questions
Region	Where exactly do you feel the pain? Does it move around or radiate elsewhere?
Severity	How would you rate your pain on a scale of 0 to 10, with 0 being no pain and 10 being the worst pain you ever experienced?
Timing/treatment	When did the pain start? What were you doing when the pain started? Is the pain constant, or does it come and go? If the pain is intermittent, when does it occur? How long does the pain last? Have you taken anything to help relieve the pain?
Understanding	What do you think is causing the pain?

TABLE 25.3 Sample PQRSTU Focused Questions

If the patient is experiencing acute pain or recent injury, focus on providing pain relief and/or stabilization of the injury prior to proceeding with the interview. Use information obtained during the subjective assessment to guide your physical examination (Table 25.4). The first question of the musculoskeletal interview is based on the six most common symptoms related to musculoskeletal disease.

Interview Questions	Follow-up	Example
Are you experiencing any current musculoskeletal symptoms such as muscle weakness, pain, swelling, redness, warmth, or stiffness?	Describe your concern today. How is it affecting your ability to complete daily activities? **P:** Does anything bring on the symptom, such as activity, weight-bearing, or rest? If activity brings on the symptom, how much activity is required to bring on the symptom? Does it occur at a certain time of day? Is there anything that makes it better or go away? **Q:** Describe the characteristics of the pain (aching, throbbing, sharp, dull). **R:** Is the pain localized or does it radiate to another part or area of the body? **S:** How severe is the pain on a scale of 0 to 10? **T:** When did the pain first start? Is it constant, or does it come and go? Have you taken anything to relieve the pain?	"My lower back has been hurting for the past week." "I can barely walk, as I feel I have to lean over and my legs are awkward. I have trouble leaning over when I brush my teeth." **P:** "I don't remember anything specific that I did that made my back start hurting, but one morning a week ago, I woke up and could barely get out of bed. The only thing that helps is a hot shower." **Q:** "When I'm just lying down, my back aches, but when I try to walk, I'd say throbbing and sometimes a sharp jab." **R:** "My lower back, just above my butt. It hurts more on the left." **S:** "Most of the time, like right now, 4, maybe 5. But when I feel that sharp jab of a knife, it's 8 to 10." **T:** "It started a week ago, when I tried to get out of bed, it was bad. It's continual pain at a 4 or 5, and then those jabs of really bad pain—they come and go. I took some ibuprofen when the constant pain was like a 7 one day, and it took it to a 3 but never went away. I never know when the stabbing pain will happen, so I can't know when to take something."
Have you ever been diagnosed with a chronic musculoskeletal disease such as osteoporosis, osteoarthritis, or rheumatoid arthritis?	Please describe the conditions and treatments.	"No, I haven't. But I don't see a doctor very often."
Have you ever been diagnosed with a neurological condition that affected the use of your muscles?	Please describe.	"No. Nothing like that."

TABLE 25.4 Focused Interview Questions Related to the Musculoskeletal System

Interview Questions	Follow-up	Example
Have you had any previous surgeries on your bones or muscles, such as fracture repair or knee or hip surgery?	Please describe.	"I broke my right arm when I was a kid. Wore a cast for a couple months. Nothing with my back or legs."
Are you currently taking any medications, herbs, or supplements for your muscles, bones, or the health of your musculoskeletal system?	Please describe.	"I take a water pill for my blood pressure. I've never had something like this happen before, so no, I don't take anything for my back. Well, I did try some ibuprofen a couple days ago, like I said."
Have you ever had a broken bone, strain, or other injury to a muscle, joint, tendon, or ligament?	Please describe.	"My broken arm, when I was a kid. That's the only thing."

TABLE 25.4 Focused Interview Questions Related to the Musculoskeletal System

LIFE-STAGE CONTEXT

Musculoskeletal Assessment Questions for the Older Adult

When assessing older adults, it is important to assess their mobility and their ability to perform ADLs:

- Do you use any assistive devices, such as a brace, cane, walker, or wheelchair?
- Have you fallen or had any near falls in the past few months? If so, was there any injury or did you seek medical care?
- Describe your mobility as of today. Have you noticed any changes in your ability to complete your usual daily activities such as walking, going to the bathroom, bathing, doing laundry, or preparing meals? If so, do you have any assistance available?

Medications also should be explored, to include prescriptions, over-the-counter medications, vitamins, and herbals, as all these sources have chemical properties that affect the human body. Effects may be intended and desired or undesired and accidental; interactions between drugs of all types should be noted in the patient's medical record.

Objective Data

The purpose of a routine physical examination of the musculoskeletal system by a registered nurse is to assess function and to screen for abnormalities. Most information about function and mobility is gathered during the patient interview, but the nurse also observes the patient's posture, walking, and movement of their extremities

during the physical examination.

During a routine assessment of a patient during inpatient care, a registered nurse typically completes the following musculoskeletal assessments:

- Assess gait.
- Inspect the spine.
- Observe the ROM of joints.
- Inspect muscles and extremities for size and symmetry.
- Assess muscle strength.
- Palpate extremities for tenderness.

While assessing an older adult, keep in mind they may have limited mobility and ROM due to age-related degeneration of joints and muscle weakness. Be considerate of these limitations, and never examine any areas to the point of pain or discomfort. Support the joints and muscles as you assess them to avoid pain or muscle spasm. Compare bilateral sides simultaneously and expect symmetry of structure and function of the corresponding body area.

Inspection

General inspection begins by observing the patient in the standing position for postural abnormalities. Observe their stance and note any abnormal curvature of the spine. Ask the patient to walk away from you, turn, and walk back toward you while observing their gait and balance. Ask the patient to sit. Inspect the size and contour of the muscles and joints and if the corresponding parts are symmetrical. Notice the skin over the joints and muscles and observe if there is tenderness, swelling, erythema, deformity, or asymmetry. Observe how the patient moves their extremities and note if there is pain with movement or any limitations in active ROM. Active ROM is the degree of movement the patient can voluntarily achieve in a joint without assistance.

Palpation

Palpation is typically done simultaneously during inspection. As you observe, palpate each joint for warmth, swelling, or tenderness. If you observe decreased active ROM, gently attempt passive ROM by stabilizing the joint with one hand while using the other hand to gently move the joint to its limit of movement. The **passive range of motion** is the degree of ROM demonstrated in a joint when the examiner is providing the movement. During palpation, a feeling of popping accompanied by a crackling noise is considered normal as long as it is not associated with pain. As the joint moves, there should not be any reported pain or tenderness.

Assess muscle strength. Muscle strength should be equal bilaterally, and the patient should be able to fully resist an opposing force. Muscle strength varies among people depending on their activity level, genetic predisposition, lifestyle, and history. A common method of evaluating muscle strength is the Medical Research Council Manual Muscle Testing scale (Naqvi & Sherman, 2023). This method involves testing key muscles from the upper and lower extremities against gravity and the examiner's resistance and grading the patient's strength on a 0 to 5 scale (Table 25.5).

0—No muscle contraction
1—Trace muscle contraction, such as a twitch
2—Active movement only when gravity eliminated
3—Active movement against gravity but not against resistance
4—Active movement against gravity and some resistance
5—Active movement against gravity and examiner's full resistance

TABLE 25.5 Muscle Strength Scale (Source: Naqvi & Sherman, 2023.)

To assess upper extremity strength, first begin by assessing bilateral handgrip strength. Extend your index and second fingers on each hand toward the patient and ask them to squeeze them as tightly as possible. Then, ask the patient to extend their arms with their palms up. As you provide resistance on their forearms, ask the patient to pull their arms toward them. Finally, ask the patient to place their palms against yours and press while you provide resistance. Figure 25.10 shows images of a nurse assessing upper body strength.

(a) (b) (c)

FIGURE 25.10 A nurse tests a patient's (a) handgrip, (b) ability to pull toward themselves, and (c) ability to push away from themselves. (credit: "Neuro Exam image 38.png," Neuro Exam image 41.png," and "Neuro Exam image 39 .jpg" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

To assess lower extremity strength, perform the following maneuvers with a seated patient. Place your palms on the patient's thighs and ask them to lift their legs while providing resistance. Second, place your hands behind the patient's calves and ask them to pull their legs backward while you provide resistance. Place your hands on the top of their feet and ask them to pull their feet upward against your resistance. Finally, place your hands on the soles of their feet and ask them to press downward while you provide resistance, instructing them to "press downward like pressing the gas pedal on a car" (Figure 25.11).

(a) (b) (c)

FIGURE 25.11 A nurse assesses lower body strength by having the patient (a) lift their legs, (b) push their legs back, and (c) push up their feet against resistance. (credit: "Musculoskeletal Exam image 2.png," "Neuro Exam image 6.png," and "Musculoskeletal Exam Image 7.png" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY)

LINK TO LEARNING

This video demonstrates an adult musculoskeletal assessment (https://openstax.org/r/77mskelassess) in about six minutes.

A comparison of expected versus unexpected findings when assessing the musculoskeletal system is summarized in Table 25.6.

Assessment	Expected Findings	Unexpected Findings (document and notify provider if a new finding)
Inspection	• Erect posture with good balance and normal gait while walking • Symmetrical joints and muscles with no swelling, redness, or deformity • Active ROM of all joints without difficulty • No spine curvature	• Spinal curvature present • Poor balance or unsteady gait while walking • Swelling, bruising, erythema, or tenderness over joints or muscles • Deformity of joints • Decreased active ROM • Contracture or foot drop present
Auscultation	• Not applicable	• Crepitus (a grating or crackling sound) associated with pain on movement
Palpation	• No palpable tenderness or warmth of joints, bones, or muscles • Muscle strength 5/5 against resistance	• Warmth or tenderness on palpation of joints, bones, or muscles • Decreased passive ROM • Muscle strength of 3/5 or less
CRITICAL CONDITIONS to report immediately		• Hot, swollen, painful joint • Suspected fracture, dislocation, sprain, or strain

TABLE 25.6 Expected Versus Unexpected Findings on Musculoskeletal Assessment

LIFE-STAGE CONTEXT

Age-Related Musculoskeletal Differences

Patients at the extremes of age, neonates and older adults, have some age-related musculoskeletal differences based on their age. The normal newborn skull bones are not fused, and assessment includes the fontanelles: depression or puffiness provides data about the baby's fluid balance. Muscle development and strength are immature, but the normal neonate is able to move the head and all extremities; ROM is assessed passively. The spine is assessed, including inspection for the presence of a dimple and/or tuft of hair, which are associated with spina bifida occulta (Mayo Clinic, 2022).

Changes associated with advanced age include sarcopenia (muscle loss), degenerative joint disease (DJD) or degenerative disk disease, a tendency of the tendons to lose elasticity, calcification of joint capsules, possible osteoporosis, and arthritis-related changes. These alterations to normal structure and function may lead to reduced flexibility and strength that may cause slower movement and impaired mobility and, in many cases, may place patients at increased risk for falls. While sarcopenia is common in older adults, it actually begins in about the third decade. There are steps that can be taken to prevent frailty and injuries, including exercise and proper nutrition. Resistance exercises show the most positive effect in the prevention of sarcopenia.

Abnormalities of the Musculoskeletal Assessment

The number of potential abnormalities that may present in the musculoskeletal assessment is vast and beyond the scope of this book and chapter. To narrow the range of possibilities, the focus herein is primarily on some of the most common aberrations, to assist the student and generalist nurse in identifying deviations from the normal

assessment. Diagnosing the specific cause of abnormal findings is within the scope of the advanced practice nurse and other such healthcare providers. In addition to the common abnormalities, exposure to a serious complication of musculoskeletal injury—compartment syndrome—is presented. Prompt recognition of signs and symptoms of compartment syndrome is essential to reduce development of more extensive injury and possible limb loss.

Change in Bone Alignment

Normal musculoskeletal function relies on bones to be aligned appropriately. Alterations to the alignment of bones can be genetic or occur from injury, infection, neoplasm, or metastasis. Even with medical or surgical intervention, fractures may heal with misalignment in bone structure, from location of the injury, abnormal healing process, or subsequent infection or inflammation.

Dislocations also cause misalignment in bone structure, at least temporarily. Some dislocations, like many fractures, are urgent or emergent, requiring prompt or immediate intervention and realignment.

Some other changes in bone alignment include the following:

- Intoeing: Commonly referred to as "pigeon-toed," is when the feet turn in; this is especially notable when walking.
- Spinal disorders: Degenerative disk disease, osteoarthritis, herniated disk, spondylolisthesis, and spina bifida are all disorders that can affect spinal alignment.
- Neoplasms and metastases: Certain cancers can cause misalignment of bone structure either by primary tumors or metastases from other regions.
- Blount disease: Also called "tibia vara," Blount disease is not a very common finding. It is a *C*-shaped bowing of the legs after toddlerhood caused by a growth disorder at the proximal epiphyseal plate of the tibia. It may be unilateral or bilateral.
- Accessory navicular bone: Not a particularly common finding, an accessory navicular bone is an extra bone in the center of the inner arch of the foot.

Change in Shape of Bone

Similar to bone alignment, bones are particular shapes for particular reasons—structurally and/or functionally. Because bones interact with other bones and connective tissues like cartilage, ligaments, and tendons, abnormal shapes can impact these related tissues and surrounding tissues. Changes in bone shape may lead to dysfunctions or, in mild cases and depending on where the shape change is, may not be symptomatic or apparent.

There are a variety of causes for changes in the shapes of bones throughout the life span. Following are some examples:

- Bone spurs may develop.
- Osteoarthritis may cause changes.
- Unicameral bone cysts, cavities filled with fluid, change the shape of (primarily) long bones in children.
- Certain cancers affect the shape of bones, including multiple myeloma and primary bone marrow lymphoma.
- Skeletal surgeries may have resultant shape changes—bone grafts, repair of fractures, and joint replacements have this potential.

Change in Length of Bone

According to Boston Children's Hospital (2005–2023) and Nationwide Children's Hospital (2023), the chief causes of discrepancies in bone length are congenital, injury or infection, or neoplasm. The impact of impaired growth on the length of bones is reduced in adulthood, as once the epiphyses calcify, growth is halted. Adults can still be affected by changes in the length of bones from residual effects of traumatic injuries, infections, or neoplasms.

Symptomatic discrepancies in bone length are most apparent in long bones, most commonly the femur and tibia (OrthoInfo, 1995–2023). The bearing of injuries, infections, or cancers on bone growth are especially significant when the epiphysis of the bone is impacted, as this is the source of long bone growth. Healing after fracture is commonly associated with slower growth; however, childhood fracture of the femur may lead to growth acceleration after the break, causing that leg to be longer than the uninjured side (OrthoInfo, 1995–2023).

More than 50 percent of people have discrepancies in leg length (OrthoInfo, 1995–2023), but when the difference is less than 1.5 centimeters, it is often not apparent, is often without symptoms, and may not even be measured and

confirmed. When the discrepancy between limbs is approximately 1.5 to 2 centimeters (or more), patients are likely to seek care and are evaluated for treatment (Figure 25.12).

FIGURE 25.12 Discrepancy in leg length: this patient's left leg is shorter than the right, with a missing fibula and notable bowing of the tibia. (credit: "Radiographic presentation of a 6 years old patient with fibular hemimelia type II" by National Library of Medicine, CC BY 2.0)

Surgical interventions include shortening the longer leg or lengthening the shorter leg (Boston Children's Hospital, 2005–2023). The following are three methods for shortening a leg:

- Resection of bone: This involves removal of a piece of bone from the longer leg; this is done after reaching adult height.
- Stapling the epiphysis: Both sides of the epiphysis are temporarily stapled; when length is equalized, the staples are removed.
- Epiphysiodesis: In epiphysiodesis, the epiphysis of the longer extremity is temporarily or permanently fused.

Crepitus

The term **crepitus** refers to a grating or crackling sound, or a finding with palpation that is described as akin to feeling crisped puffed rice under the fingers. In relation to the musculoskeletal system, it is associated with the sound of bones rubbing together. This is often apparent with joint movement. Crepitus can be a normal finding, but it is considered abnormal when accompanied by pain. In such circumstances, ROM may also be limited, and complete assessment of the joint may require passive instead of active ROM.

Pain

Many musculoskeletal issues can cause the patient to feel pain. Examples include the result of arthritis, injury, infection, joint dislocation, surgery, and some of the misshapes or misalignments previously discussed. Pain results from acute events and may also become chronic. Chronic musculoskeletal pain is a major contributor to worldwide disability (El-Tallawy et al., 2021). The most common regions of musculoskeletal pain include the low back, neck, and shoulders. Patients are affected by pain in various ways and in their abilities to perform self-care activities, work, and maintain an acceptable quality of life. With increasing age, the potential for experiencing musculoskeletal pain increases.

LIFE-STAGE CONTEXT

Older Adults and Joint Pain

Osteoarthritis (OA) is a degenerative disorder with repeated episodes of inflammation and joint damage leading to loss of cartilage within joints. Pain results as bones move within the joint without the cushion normally provided by cartilage. Limited movement may follow as pain and deterioration advance. Older adults are more prone to OA as it is known as a disorder of use; therefore, advancing age shows the results of years of use and perhaps overuse.

Chronic pain also places a burden on healthcare systems and costs, which can be seen in the number of visits to healthcare providers, surgeries, assistive devices, and disability (El-Tallawy et al., 2021). Use of over-the-counter (OTC) and prescription medications are another example of high use and high impact on healthcare costs. When patients are prescribed medications to treat musculoskeletal pain, prescription may focus strictly on pain, as is apparent with opioids, or aim to treat inflammation as the source of pain. Because musculoskeletal pain often involves muscle spasms, a medication regimen may include a drug for pain, an anti-inflammatory, and a muscle relaxant.

It is important for nurses to assess a patient's pain before and after administering medications. Commonly, a numeric scale is used for adults who are able to comprehend a 0 to 10 scale of pain from none through severe (Figure 25.13). Alternatively, there are pain scales with faces showing different expressions denoting levels of pain—these are helpful for pediatric patients and adults who do not understand a number-based scale.

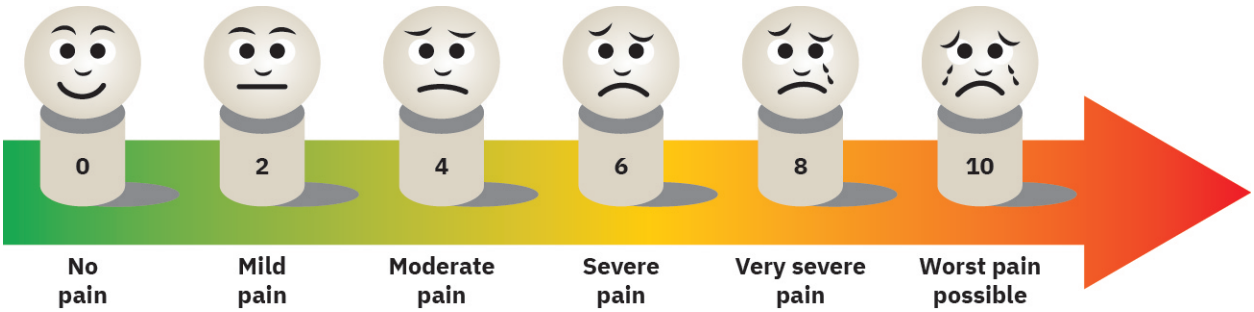


FIGURE 25.13 This example of a pain scale includes numbers, expressive faces, and verbal descriptions, which can be used with different patient populations. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Nurses must use different techniques for assessing pain in patients who are unconscious or otherwise unresponsive. Those nurses who work with such patients rely heavily on their assessment skills relative to nonverbal cues to evaluate patients' pain and their responses to varied interventions. The critical-care pain observation tool (CPOT) allows nurses to score such patients objectively through four parameters: facial expression, body movements, ventilator compliance, and muscle tension.

LINK TO LEARNING

This video details the assessment of a nonverbal, intubated patient (https://openstax.org/r/77nonverb) using the CPOT. Watch the video to learn how to use the CPOT to assess pain in critically ill patients who are unable to verbalize or point to a number or image.

Decreased Range of Motion

Limitations to ROM can fall anywhere along a spectrum from mild decrease of ROM to a total lack of movement. Such immobility may be physiological, as in the case of residual damage after an injury or a cardiac event like myocardial infarction or stroke. Decreased ROM may also reflect treatment as in the case of certain internal or external fixation devices, braces, and supports. Inflammation, pain, wounds, stiffness, muscle spasm, and contracture can all limit ROM, as can the neurological system. Because movement begins with a neurological signal, anything impacting the transmission of such signals can impact movement and ROM.

Assessment of a decrease in ROM may be diagnostic on its own or contributory to diagnosis, as certain traits direct advanced practitioners to differential diagnoses. Treatments prescribed may also contribute to limitations in ROM; examples are varied and may include muscle relaxants and/or analgesics. There are multiple subclassifications of drugs used to treat muscle spasm and pain, and selection by the prescriber is often based on the mechanism of action (MoA) of the drug. Pain medicines may be focused purely on analgesia, or the MoA may be anti-inflammatory. Therefore, identifying the cause or mechanism of injury or restriction is important for the most effective treatment plan and results.

Compartment Syndrome

The condition known as **compartment syndrome** occurs when increased pressure in a confined body space compromises blood flow to muscles and nerves, causing tissue ischemia (lack of blood and oxygen). If not treated promptly, this has the potential to cause tissue death. Compartment syndrome tends to occur following an injury and subsequent inflammation of the limbs or torso. This inflammation increases the pressure in these compartments leading to ischemia. Compartment syndrome can be acute or chronic. Acute compartment syndrome is an emergency and is most often seen after traumatic injuries (penetrating, crush, fractures), with tight-fitting casts, and after revascularization procedures (Torlincasi et al., 2023). Chronic compartment syndrome is caused by pressure from swelling of muscle during exercise but usually resolves with rest.

Signs and symptoms of compartment syndrome include the following:

- Positive findings for the five *P*'s:
  - pain out of proportion to extent of injury, worsened by the passive stretch of the muscle
  - pallor, poor/pale skin color, and delayed capillary refill in distal extremity
  - **pulselessness**, lack of palpable pulse in distal extremity
  - **paresthesia**, loss of sensation or tingling in the extremity
  - **paralysis**, inability to move, or loss of function of the limb, a late sign indicating muscle damage
- Tightness or fullness in the compartment affected
- Difficulty moving the affected compartment
- Coolness felt distal to the area

When caring for a patient who is at risk for developing compartment syndrome, frequent assessment of the affected limb should be performed. This should include measurement of the diameter of the limb with a tape measure, in addition to frequent inspection and palpation of the affected area for any change in appearance or temperature. The location of measurement should be marked upon the first measurement, and subsequently, the same site should be used in order to ensure measurement comparisons are accurate. These serial measurements are extremely important. Comparison of the limb with the other limb is also helpful. The appearance of any of these symptoms is urgent, and the provider should be notified immediately for medical and/or surgical intervention.

Validating and Documenting Findings

After completion of the nursing assessment, whether it be initial or a follow-up, the nurse should promptly document the data collected. It is recommended for charting to be done as soon as possible after the assessment or event, to avoid forgetting key details. Another reason for prompt documentation is to avoid confusing the details of one patient with another. Remember to include any interventions performed during your assessment.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Postoperative Total Hip Replacement Patient

The nurse is assisting and educating a patient who has had total hip replacement surgery with positioning and mobility. Priority interventions are focused on avoiding dislocation of the operative joint. This involves avoiding adduction of the operative leg. The following points should be followed and explained to the patient:

- Avoid twisting or adduction of the operative leg; do not cross legs.
- Use the abduction pillow for proper positioning while in bed.
- Do not bend more than 90 degrees forward.
- Use raised seats (including toilets) to maintain knees lower than hips.

- When ambulating, use rolling walker and remember, “nose over toes”:
- Slide the operative leg forward first, followed by the nonsurgical leg forward.

Here is sample documentation of expected findings after a musculoskeletal assessment:

> Patient reports no previous history for bone trauma, disease, infection, injury, or deformity. No symptoms of joint stiffness, pain, swelling, limited function, or muscle weakness. Patient is able to perform and manage regular daily activities without limitations and reports consistent exercise consisting of walking 2 miles for five days a week. Joints and muscles are symmetrical bilaterally. No swelling, deformity, masses, or redness upon inspection. Nontender palpation of joints without crepitus. Full ROM of the arms and legs with smooth movement. Upper and lower extremity strength is rated at five out of five. Patient is able to maintain full resistance of muscle without tenderness or discomfort.

Here is sample documentation of unexpected findings after a musculoskeletal assessment:

> Patient reports, “I felt a pop in my right ankle while playing basketball this afternoon” and “My right ankle hurts when trying to walk on it.” Pain is constant and worsens with weight-bearing.
>
> Patient rates pain at 4/10 at rest and 9/10 with walking and describes pain as an “aching, burning feeling.” Ibuprofen and ice decrease pain. Right ankle is moderately swollen laterally and anteriorly with tenderness to palpation but no erythema, warmth, or obvious deformity. Color, motion, and sensation are intact distal to the ankle. ROM of the right ankle is limited and produces moderate pain. Minimal eversion and inversion demonstrated. Patient is unable to bear weight on the right ankle. Dr. Smith notified, and an order for an ankle x-ray received. The right ankle was elevated and ice applied while the patient waits for the x-ray.

25.3 Recognizing Common Musculoskeletal Disorders

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Examine musculoskeletal disorders affecting the spine
- Recognize musculoskeletal disorders affecting the wrists, hands, and fingers
- Identify musculoskeletal disorders affecting the feet and toes

The spine offers support for the body, allowing humans upright posture. The structure of the spine also offers protection for the delicate spinal cord. Muscles and other tissues assist the spine with strength and support as well as foster some flexibility and movement. Because the spine provides protection for the delicate spinal cord, it is important for nurses to keep this in mind when assessing patients with any symptoms or deviations from normal spinal structure and/or function. Disorders, deformities, and injuries lead to varying levels of pain and dysfunctions ranging from minor to life threatening.

Variations from the normal curvature of the spine can cause mild, moderate, or severe changes in posture and may lead to pain as muscles and other structures accommodate alterations; limited or absent ability to stand or walk may be or become apparent. The neurological impacts of the spinal cord being moved or squeezed may include paresthesia, pain, or movement limitations, from minimal to total. Patients may be unable to complete ADLs, and have increasing reliance on others for daily care. Changes in tone may become evident, with resultant flaccidity or spasticity associated with the impaired structure and function.

In addition to spinal disorders, there are disorders that affect wrists, hands, and fingers of the upper extremities, and feet and toes of the lower extremities. Some of the common diagnoses affecting these specific regions are important to be explored as they need to be considered as the nurse performs a musculoskeletal assessment. Again, knowing normal conditions and having an awareness of some of the potential abnormal conditions can be very important for the bedside nurse’s contribution to patient care.

Disorders Affecting the Spine

The vertebral, or spinal, column is composed of a sequence of vertebrae, each pair joined by intervertebral disks. The spinal column has flexibility, allowing for movement as well as providing support for the head, neck, and body. The spinal cord runs through openings in the posterior of the vertebrae; the bony structure of the spine protects the

spinal cord.

There are normally four curves along the length of the spinal column in adults (Figure 25.14). These curves increase strength, flexibility, and ability of the spinal column to dissipate shock. With certain efforts, like lifting and carrying heavy loads, the spine is under more pressure and accommodates by an increase in the depth of the spinal curves. When the pressure is relieved, for example, by putting the heavy load on the ground, the normal curvature is restored.

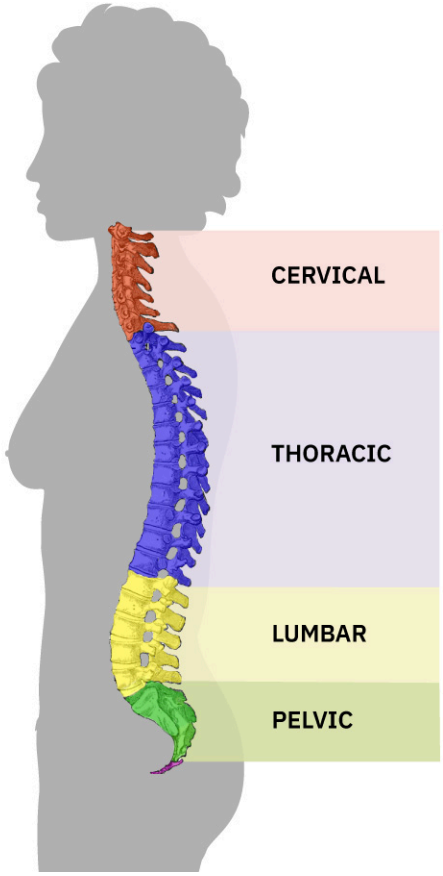


FIGURE 25.14 This is the normal curvature of the spine. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LINK TO LEARNING

C1, or the atlas, is thusly nicknamed because Atlas was the Greek Titan who held the sky above the earth for eternity (GreekMythology.com [1997–2021]). C1, C2 (axis), and C7 are each uniquely shaped vertebrae, with C3 through C6 structurally similar. See diagrams and descriptions of the cervical vertebrae (https://openstax.org/r/77cervvert) in this video.

There are several disorders that can occur in the vertebral column that affect its normal motion and curvature, causing pain and decreased quality of life. Common conditions seen include flattening of the lumbar curvature, hyperlordosis, kyphosis, scoliosis, and ankylosing spondylitis.

Flattening of the Lumbar Curvature

The lumbar spine normally displays a mild **lumbar lordosis**, or inward curve above the buttocks, which allows for normal, upright posture, with accompanying ability to look straight ahead. If the lordotic curve is absent, this manifests by a flattened lumbar curve, or "**flatback syndrome**." Patients adjust in order to stand upright, which may be subconscious or conscious, as hips and C-spine are extended, and knees flexed (Burhan et al., 2020). These adjustments are tiring, and by days' end, patients are often fatigued, and forward stooping is more pronounced (Asher, 2023; Cedars-Sinai, 2023). Pain is also frequently associated with this disorder, also increasing throughout a

day of postural adjustments while the patient attempts to complete ADLs and perhaps activities associated with a job and other extended daily activities.

A common cause of flatback syndrome is surgical correction of other spinal disorders, (Figure 25.15). Other associated causes include congenital disorders, degenerative disk disease, trauma, osteoporosis, and compression fractures.

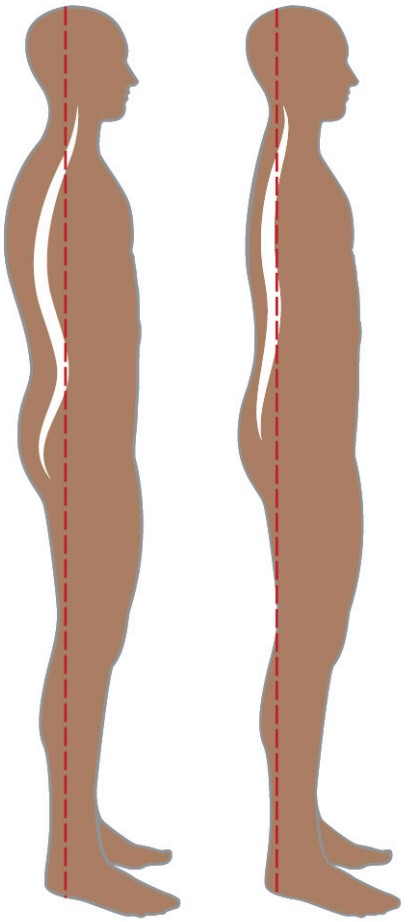


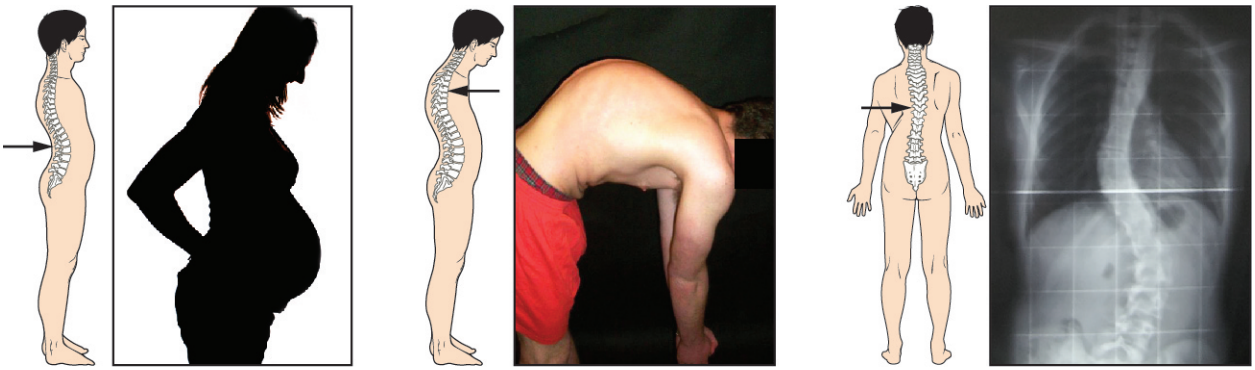
FIGURE 25.15 (a) A skeleton and body in normal alignment and posture, and (b) a body with flattening of the lumbar curve (flatback syndrome). (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Hyperlordosis

Just as a lack of curve in the lumbar region can cause problems and symptoms, an excessive lordotic curve (**hyperlordosis**) can become an issue (Figure 25.16). The posture of hyperlordosis is characterized by a protrusion forward of the stomach, and rearward of the bottom—this exaggerates the C of the lumbar curve and can cause pain, especially in the neck and perhaps the lower back (Hecht, 2018). Hyperlordosis may also be referred to simply as lordosis, or by the nickname "swayback." The situation is often temporary and reversible; if the patient maintains flexibility, the impact on mobility is expected to be minor. As stiffness becomes apparent, however, restriction of movement is possible.

Some of the causes of hyperlordosis include obesity and advanced pregnancy, injury to the spine, long-term sitting or standing or wearing high-heel shoes, a weakened core, rickets, or some neuromuscular disorders (e.g., osteoporosis, osteosarcoma, spondylolisthesis, muscular dystrophy) (Cleveland Clinic, 2023; Hecht, 2018). The provider may use radiographic testing such as x-ray, computed tomography, or magnetic resonance imaging, along with physical examination, to assist in diagnosing the cause of hyperlordosis.

Once the diagnosis and likely cause are identified, treatment may include a combination of physical therapy with exercises to increase strength and flexibility and a brace for back support. If the patient has been experiencing pain, anti-inflammatory drugs may be recommended. In extreme circumstances, surgery may be necessary to fuse and straighten the spine (Cleveland Clinic, 2023). Nurses are involved in assessing interventions, including patient willingness and compliance and response to prescribed treatments.



(a) Hyperlordosis **(b)** Kyphosis **(c)** Scoliosis

FIGURE 25.16 Spine disorders, such as (a) hyperlordosis, (b) kyphosis, and (c) scoliosis can cause mild to extreme function and mobility problems. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Kyphosis

An exaggeration of the curvature of the thoracic spine is called **kyphosis**, though it has been referred to by the nicknames "hunchback" and "dowager's hump" (Figure 25.16). The nicknames are not flattering or scientific and are therefore discouraged. A currently accepted nickname is more descriptively, "roundback." Like other spinal disorders, causes are varied and include congenital defects, spinal trauma and healing, degenerative disease (e.g., arthritis), osteoporosis, and less frequently, disorders of connective tissue, tumors in the spine, polio, and muscular dystrophy.

Depending on the severity of curvature, symptoms may be absent or mild or may be extreme. During assessment, the nurse may notice unequal shoulder height and shoulders that are rounded; the upper back may have a visible and palpable hump. With these physical alterations from normal, the patient may notice stiffness and/or pain in the upper back or shoulders, and the hamstrings may not be flexible. The patient may tire easily. In severe cases, the patient may notice paresthesias or numbness, urinary or bowel incontinence, or dyspnea from restricted chest expansion (Gabbey & Cohen, 2023). Patients with kyphosis also suffer from poor body image.

Treatment for kyphosis is based on symptoms and limitations relative to mobility and ability to perform ADLs. Nurses interact with patients in outpatient settings while noninvasive interventions are attempted. This may include assessment of pain control measures; strength and flexibility improvement from physical therapy; and ongoing exercises for the core, back, and posture. Some patients may benefit from a back brace, and success or lack of improvement should be evaluated and noted. Surgery is not common, but in cases of respiratory compromise or incontinence, surgery may be necessary.

Scoliosis

A horizontal curvature of the spine is diagnosed as **scoliosis** (Figure 25.16). This is a common disorder and is often diagnosed during adolescence, although some cases occur and are diagnosed much younger. When a nurse is assessing a patient's spine, it is routine to have the patient stand facing away from the nurse. This provides an opportunity to inspect the spine while the patient is upright. To further the assessment with scoliosis in mind, the nurse asks the patient to bend forward at the waist, and the nurse observes for shoulder placement. Uneven shoulders in this position are a sign of scoliosis (Mayo Clinic, 2023). Other signs include an uneven waist and hips, a shoulder blade more prominent than the other, or a side of the rib cage that is more forward than the other.

LINK TO LEARNING

Watch this demonstration of a scoliosis assessment (https://openstax.org/r/77scoli) that provides steps and descriptions of normal and abnormal findings. Think about the findings as if you were the examiner.

Scoliosis may be mild, with only a small spinal curvature and mild or no symptoms, or it can be severe, and the patient may be required to use a wheelchair. Symptoms can be anywhere between the two ends of the spectrum. Once diagnosed, healthcare providers usually follow patients on a regular basis, with radiographs and examination, to evaluate any progression of the curvature and symptoms.

Scoliosis is sometimes considered hereditary, with appearances within family lines. Often, the occurrence of scoliosis is idiopathic, with no specific cause identified. In some cases, a diagnosis like muscular dystrophy or cerebral palsy is the cause of the spinal curvature. Other potential causes include spinal infection or trauma, congenital deformity affecting bone development, and diagnosis of a spinal cord disorder. Girls tend to be at increased risk for development of scoliosis, and symptoms tend to appear in adolescence (Mayo Clinic, 2023).

LIFE-STAGE CONTEXT

Scoliosis in the Adolescent

An assessment of the spine for curvature associated with scoliosis is a frequent part of a routine physical examination for an adolescent patient. Manifestations of scoliosis that the examiner looks for include a visible horizontal deviation from the normal straight spinal column, uneven shoulders while standing erect and as seen from behind while bending forward at the waist, prominence of one scapula in comparison to the other, an uneven waist, asymmetrical rib cage, and hip deviation with leg length discrepancy (Mayo Clinic, 2023).

Severe cases of scoliosis may impact respiratory function, as expansion of the lungs may be reduced by size and shape of the thoracic cage. Signs and symptoms are prone to worsening as the spinal curve increases over time. Treatment depends on severity, as mild cases often require no treatment and are simply monitored for changes. Once bone growth is complete, progression is slow; with this in mind, treatments tend to be more effective in growing children (Mayo Clinic, 2023). Application of a brace is helpful in prevention of worsening of the curvature, so this is a common treatment for the growing child, and individual patient response should be assessed at each healthcare visit.

Surgery is an option used to straighten the spinal curve, with hopes of preventing it from worsening over time. Of course, surgery is not without potential complications, including some of the spinal deformities already discussed. Surgeries for treatment of scoliosis include use of a rod (or two) that is adjusted in length with the patient's growth, every few months (Mayo Clinic, 2023). Another option is spinal fusion, which connects multiple vertebrae to prevent individual movement; this may be done with rods, screws, or pins. Tethering of the vertebral body is another method in which screws are utilized on the outer part of the curve of the spine, and a cord is inserted through them. The spine is straightened as the tether is made taut. Nurses are involved in educating the patient and family throughout diagnosis and treatment, and during postoperative care, frequent assessment of neurological and musculoskeletal function is critical. Additionally, the postoperative patient should be assessed for bleeding at the surgical site. Infection is a risk with any invasive procedure.

Ankylosing Spondylitis

The chronic inflammatory disease **ankylosing spondylitis** is within the category of arthritis, primarily of the spine and sacroiliac joint (Figure 25.17). The inflammatory process causes abnormal formation of new bone, which leads to fusion (permanently joining together) of involved vertebrae. This produces a flattening of the affected area of the spine, limits movement in the region, and alters posture (Mayo Clinic, 2023). Ankylosing spondylitis may affect other joints as well, and interestingly, it may affect eyes, specifically with a condition called anterior uveitis (Doherty, 2021). The most common symptom is lower back pain; other symptoms include kyphosis, stiffness, heel and other joint pain (**enthesitis**—inflammation of the area of attachment of ligament or tendon to bone), and malaise or fatigue, as systemic inflammatory symptoms.

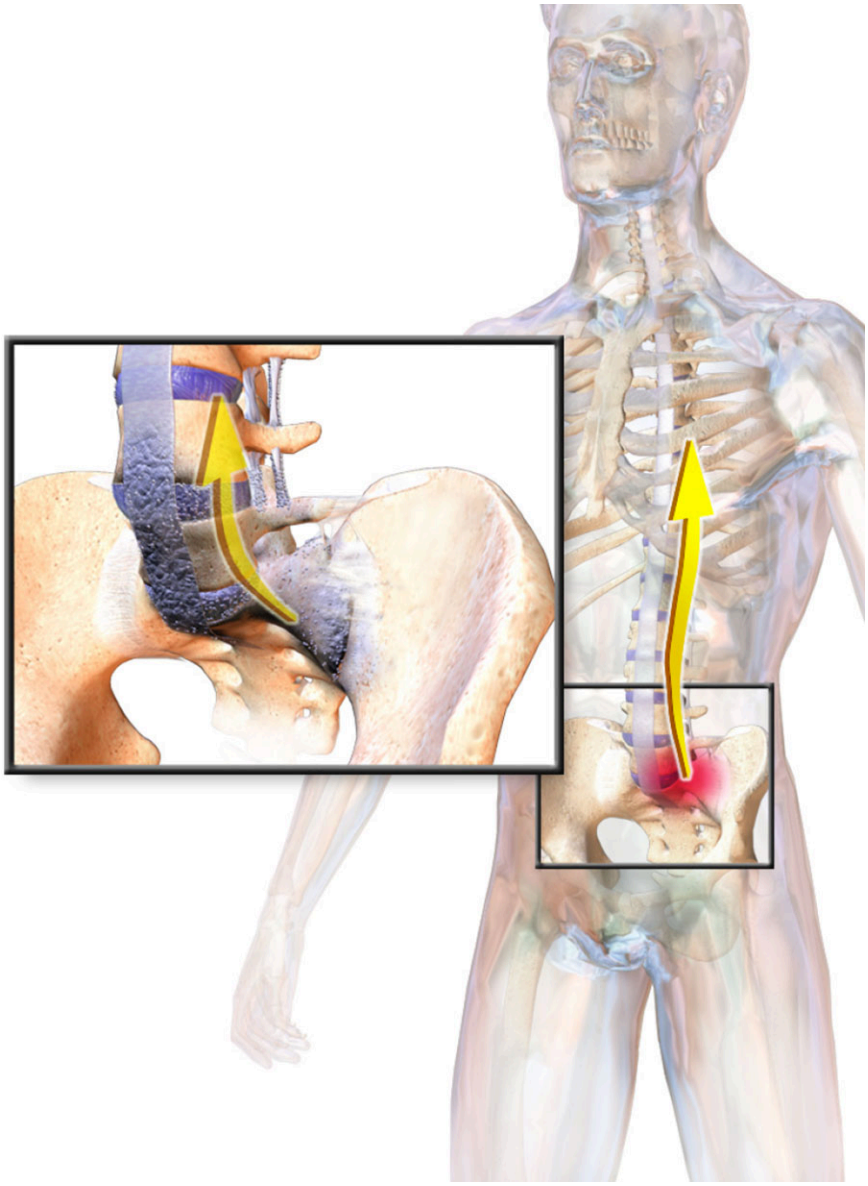


FIGURE 25.17 The processes of inflammation, bone formation, and fusion are involved in ankylosing spondylitis. (credit: "Blausen 0037 AnkylosingSpondylitis.png" by "BruceBlaus"/Wikimedia Commons, CC BY 3.0)

Symptoms may demonstrate differences based on sex, although men and women may experience any or all symptoms (Doherty, 2021). Back pain tends to occur in both sexes as the most common symptom; neck, knee, hip pain, fatigue, and depression are experienced more often in women. Men present more often with foot pain. Nurses should be alert for certain common characteristics of inflammatory back pain, including chronicity, with typically slow onset in patients under 40 years old. Symptoms tend to improve with exercise and not by resting. As a matter of note, symptoms may be even worse at night, severe enough to wake the patient. Because the disorder is inflammatory, drug therapy with nonsteroidal anti-inflammatory drugs (NSAIDs) is often effective.

While rare, a potential neurological emergency for patients with ankylosing spondylitis is compression of the spinal cord. Symptoms the nurse may notice on assessment include a burning pain from buttocks to arms and legs, numbness in extremities, a loss of coordination of the hands, or foot drop (Johns Hopkins, 2023). The **cauda equina syndrome** may cause loss of bladder or bowel function, increasing leg numbness, and pain. Most spinal cord compression is treated conservatively, with anti-inflammatory drugs (e.g., steroids or powerful NSAIDs) and physical therapy for strength enhancement of the legs and core. Surgery may be indicated for severe situations, and cauda equina syndrome may require emergent surgical intervention (Johns Hopkins, 2023).

LINK TO LEARNING

A discussion guide about ankylosing spondylitis (https://openstax.org/r/77anky) designed for patients to use in anticipation of an appointment with a healthcare provider gives ideas for questions patients may have. Consider how these can be helpful for nurses who are interviewing and assessing patients with musculoskeletal concerns.

Degenerative Joint Disease

The **degenerative joint disease (DJD)**, also known as **osteoarthritis**, is a common disease that occurs with age. Joints, especially those that bear the body's weight or move in chronic repetitive motion, are prone to inflammation and structural joint damage (American Academy of Physical Medicine and Rehabilitation [AAPM&R], 2024). The constant cycle of inflammation and joint damage leads to a loss of the articular cartilage cushion, creating pain, inflammation, and limited joint movement. In addition to advancing age, other risk factors for DJD are obesity, a family history of DJD, and joint injury or overuse. Women are more prone than men to experience DJD, especially after age 50 years (Centers for Disease Control and Prevention, 2023). While weight-bearing joints (spine, knees, and hips) are more prone to development of DJD, fingers can also be affected.

There is no cure for osteoarthritis, but several treatments can help alleviate the pain. Treatments may include weight loss, low-impact exercise, and medications such as acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs), and celecoxib. For severe cases of DJD, joint replacement surgery may be required.

LINK TO LEARNING

The videos provided here are of the hip and knee, but the degenerative pathophysiology of osteoarthritis (https://openstax.org/r/77osteo) is explained here and is the same wherever the joint.

Osteoporosis

The disease **osteoporosis** causes thin and weakened bones that become fragile and break easily (Figure 25.18). Osteoporosis is common in older women and often occurs in the hip, spine, and wrist. To keep bones strong, patients at risk are educated to eat a diet rich in calcium and vitamin D, participate in weight-bearing exercise, and avoid smoking. If needed, medications such as bisphosphonates and calcitonin are used to treat severe osteoporosis.

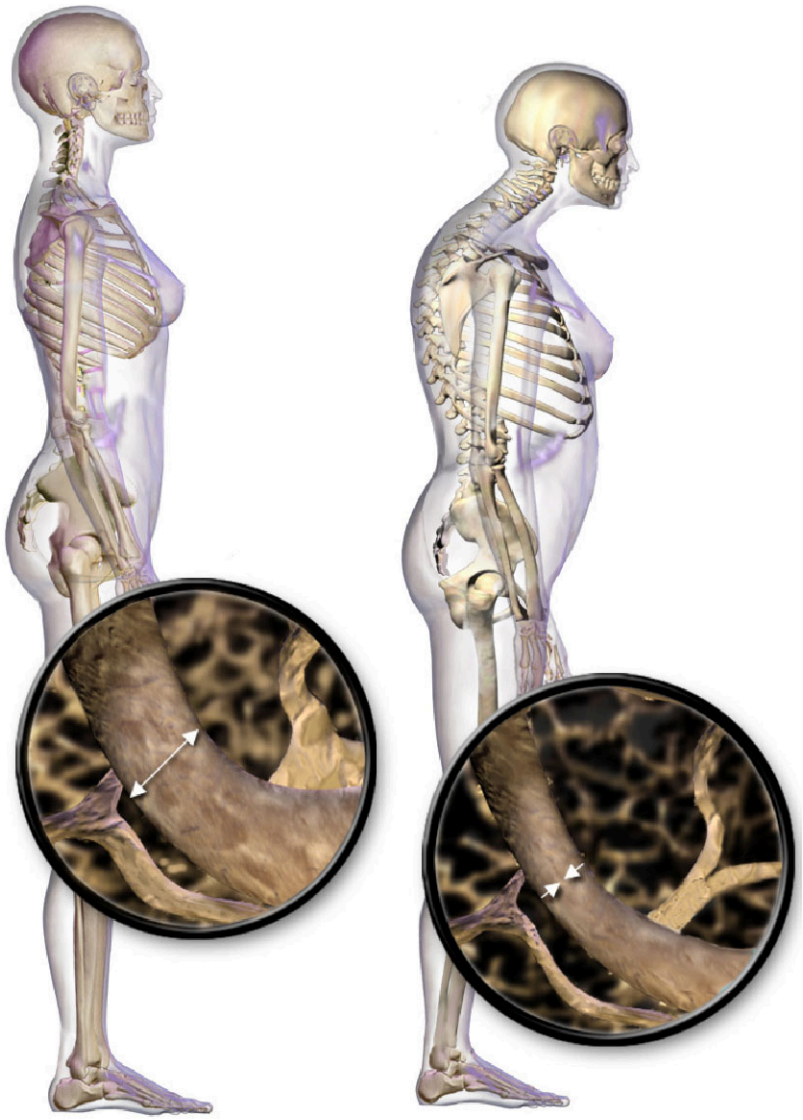


FIGURE 25.18 (a) This is normal bone compared with (b) bone with osteoporosis. (credit: "Blausen 0686 Osteoporosis 01.png" by "BruceBlaus"/Wikimedia Commons, CC BY 3.0)

PATIENT CONVERSATIONS

Osteoporosis

Scenario: Miss Nilsen is 60 years old and postmenopausal. She is meeting with the nurse after seeing her primary care provider about her bone density scan results. The nurse has been asked to provide education about osteopenia, osteoporosis, and Miss Nilsen's next steps.

Nurse: Miss Nilsen, I'm Luisa, I think we've met before. I've been asked to talk with you about your bone density scan results.

Patient: Dr. Rand says I have weak bones but I don't have osteoporosis? What's the difference?

Nurse: Your situation is some bone loss or weakening, called osteopenia. This has not progressed to osteoporosis; the nice thing about finding out now is you can take some steps to prevent it from worsening.

Patient: What do I need to do? Dr. Rand mentioned a medicine.

Nurse: Yes, your healthcare provider is considering starting you on a prescription for alendronate. You had lab work done recently, and your calcium level is fine, but like so many people, your vitamin D is low. Before you can start the alendronate, you should have normal vitamin D, so let's talk about how much vitamin D to take. Because vitamin D and calcium work together to strengthen your bones, I'll show you how much calcium to take too. In three months, we'll have you come to have a retest.

Patient: I can't start the osteoporosis drug now? I sure don't want this to get worse.

Nurse: Not until your vitamin D is normal so you have the right building blocks for it to work. First, vitamin D is dosed in international units—you'll see it on the bottle as IU. Because you are past menopause, the recommendation is for you to have 800 IU of vitamin D every day. Calcium is dosed in milligrams, which on the bottle will be mg. Every day you should take in 1,200 mg. This is between food and fluid intake, and the supplement. I have a list of food and drinks and their usual amounts of calcium and vitamin D; we can circle those you eat regularly and come up with the right amount you need from the supplements.

Patient: Okay, I'm sure glad you've got this written down, and we'll write down the foods and stuff too. This is all a bit confusing.

Nurse: Absolutely! It's a lot to remember, so you'll get to take these with you. Do you get any sun? How about exercise?

Patient: I'm so pale, I try to avoid the sun and put on a high number sunscreen, like SPF50, which almost blocks all ultraviolet rays—98 percent (MacGill, 2018). I like to swim, I do that a few times a week.

Nurse: Yes, you are fair, so sunscreen is good to prevent skin cancer. But twenty or thirty minutes of sun daily can help your body produce and use vitamin D. You don't have to expose your whole body to get the benefit—maybe alternate limbs and expose one at a time for ten minutes, three times a day? Instead of swimming, or in addition to it, could you could do some walking? Exercises that put weight on your bones helps more for making and keeping strong bones.

Patient: Maybe I can walk on my lunch break, so I can get sun and make my bones stronger at the same time.

Nurse: That should help, along with the supplement. Do you think you can add the vitamin D supplement and walking at least three times a week? For three months—until you come in for a repeat blood test?

Patient: I can try. I'll pick up the supplements on my way home and start tonight.

Disorders Affecting the Wrists, Hands, and Fingers

The small and specialized bones of the wrists, hands, and fingers are prone to disorders, some unique to their locations and some common with other regions. Other musculoskeletal structures, muscles, tendons, and ligaments, can also be impacted by injuries and disorders, whether specific to the region or broader in occurrence. Rheumatoid arthritis, for example, is a systemic autoimmune disorder, so effects can be anywhere and in multiple places. Osteoarthritis is common in the hands (especially fingers) and also the spine, hips, and knees. Similarly, tenosynovitis can occur with tendons around the body. But, De Quervain tenosynovitis is localized to the wrist, with tendon inflammation at the base of the thumb. Carpal tunnel syndrome is another disorder specific to the palm side of the hand. These conditions are further examined in this section.

Rheumatoid Arthritis

In **rheumatoid arthritis (RA)**, pain, swelling, stiffness, and loss of function in joints is due to inflammation caused by an autoimmune disease. See Figure 25.19 for an illustration of RA. It often starts in middle age and is more common in women (AAPM&R, 2024). Rheumatoid arthritis is different from osteoarthritis because it is an autoimmune disease, meaning it is caused by the immune system attacking the body's own tissues. In RA, the joint capsule and synovial membrane become inflamed. As the disease progresses, the articular cartilage is severely damaged, resulting in joint deformation, loss of movement, and potentially severe disability.

There is no known cure for RA, so treatments are aimed at alleviating symptoms. Medications such as NSAIDs, biologics, corticosteroids, and antirheumatic drugs such as methotrexate are commonly used to treat RA.

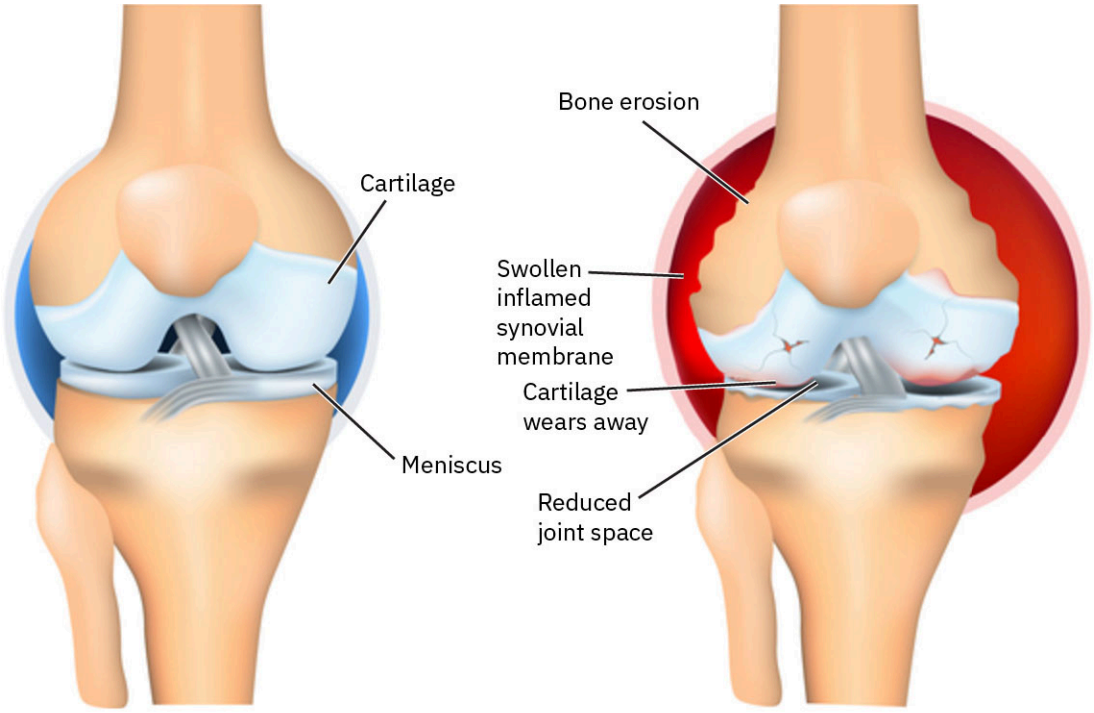


FIGURE 25.19 (a) This shows a normal knee joint and (b) joint changes associated with rheumatoid arthritis, including inflammation, loss of cartilage, and erosion of bone. (credit: modification of work "Rheumatoid-Arthritis.png" by National Library Of Medicine US/Wikimedia Commons, Public Domain)

CLINICAL JUDGMENT MEASUREMENT MODEL

Analyze Cues: Patient with Rheumatoid Arthritis

Mrs. Jackson is a 52-year-old female who visits her primary care provider for swollen, sore hands. The nurse, Marcus, interviews Mrs. Jackson and discovers the following:

Personal history of hyperlipidemia, hypertension, obesity, and prediabetes. Family history of hypertension and coronary artery disease in both parents; mother with stiff hands she called "rheumatism." Mrs. Jackson describes always being stiff in the mornings and that for the past three days she has had no appetite, felt extra tired, and had a bit of fever. Marcus's assessment includes vital signs: HR 88, BP 140/92, T 99.3°F (37.4°C), SaO_2 95 percent on room air. He notices both hands are warm, with bilateral edema and erythema at the metacarpal phalangeal (MCP) and proximal interphalangeal (PIP) joints; her fingers hurt when touched, and ROM of the fingers is limited by pain. Marcus's analysis of cues leads to his conclusion that those cues valuable for the next steps of nursing care include the mother's "rheumatism," or RA, the patient's morning stiffness, flu-like syndrome (malaise, low-grade fever, anorexia), and inflamed MCP and PIP joints.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Evidence-Based Practice and Postoperative Care of the Musculoskeletal Surgery Patient

Definition: The nurse incorporates clinical skills, current evidence, and preferences of the patient and family in professional nursing care.

Knowledge: The nurse explains the importance of a professional practice based on evidence.

Assessment of pain and readiness to ambulate are both essential for recovery and are interrelated. Adequate pain control is necessary for patients to reposition, sit and dangle at the bedside, and feel ready to stand and walk. Protocols such as the Enhanced Recovery After Surgery (Zhang et al., 2018) guide practice through evidence relative to the importance of pain control through medication as prescribed, proper positioning, and application of ice packs, and the value of early ambulation in prevention of complications (e.g., deep vein thrombosis [DVT], pneumonia, constipation, and ileus).

Skill: The nurse will maintain a professional practice that includes current evidence-based materials.

- Maintaining currency in practice through continuing education (CE)
- Reading peer-reviewed journal articles relative to professional practice
- Reading and following new protocols as they are established

Attitude: The nurse recognizes the significance of ongoing evidence-based clinical practice development.

Ganglion Cyst

A **ganglion cyst** is a fluid-filled lump that most often occurs at the back of the wrist, over tendon sheath or joint (Figure 25.20). They can also develop on the end joint or base of a finger. The exact cause is unknown, but they are most common in women, younger people between ages 15 and 40 years, and gymnasts who repeatedly apply stress to the wrist.

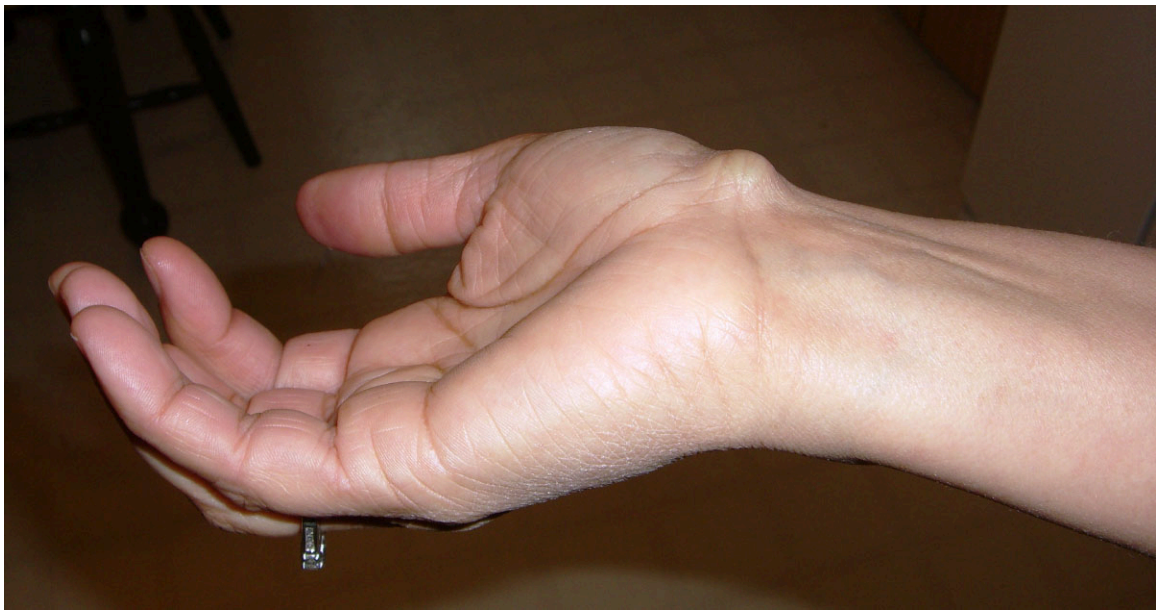


FIGURE 25.20 This shows a ganglion cyst as it appears at the wrist. (credit: modification of work "Cyst Profile2.JPG" by "GEMalone"/Wikimedia Commons, CC BY 3.0)

Some ganglion cysts disappear on their own with joint rest or splinting of the wrist. In some cases, where there is pain, aspiration of the fluid may help to relieve pain, but the cyst may grow back. Surgical removal can also be done to remove the root of the cyst and the tendon sheath involved (Pidgeon & Jennings, 2022).

Tenosynovitis

Inflammation of a tendon is termed **tendonitis**; **tenosynovitis** is a term for inflammation of not only the tendon but also the surrounding sheath. Such inflammation often affects extensor and flexor tendons of the wrists. It can be caused by autoimmune disorders such as RA or overuse of the tendon. It can also be caused by infection, such as from animal bites, a **skin commensal** (organism that normally resides on our skin), *Staphylococcus aureus*, or methicillin-resistant *S. aureus* (MRSA). Two common types of tenosynovitis seen are De Quervain tenosynovitis and stenosing tenosynovitis.

De Quervain tendonitis occurs on the thumb side of the wrist. Patients feel pain when turning their wrist, grasping, and making a fist (OrthoInfo, 1995–2023). The cause is not known, but repetitive hand and wrist movements can make the pain worse.

Treatments for De Quervain tendonitis include splinting the wrist and hand, NSAIDs, and avoidance of painful activities and positions. Corticosteroid injection is a possible treatment, as is surgical intervention involving release of the tendon sheath.

In **stenosing tenosynovitis**, nicknamed "trigger finger," the flexor tendons of a finger or thumb freeze in the bent position (Figure 25.21). The patient may report clicking when bending and/or straightening the finger, as well as pain and stiffness. This type of tenosynovitis is common in patients with diabetes, and the risk for development increases with advanced age.

FIGURE 25.21 This shows the clicking or catching involved in trigger finger. The flexor tendons of the finger are frozen in the bent position. (credit: modification of work "Surgical decompression of trigger finger" by National Library of Medicine, CC BY 2.0)

LINK TO LEARNING

Learn about the distinctive movements of trigger finger (https://openstax.org/r/77triggfing) in this article.

Treatment includes rest, splinting, NSAIDs, and stretching exercises. Like De Quervain syndrome, steroid injection may be beneficial. Surgery to release the pulley to allow the flexor tendon to glide freely may be performed. Postoperative assessment by the nurse for treatments of tenosynovitis will be the same as for ganglion cyst postprocedure care.

Carpal Tunnel Syndrome

In the wrist, the carpal bones and the flexor retinaculum form a passageway called the carpal tunnel, with the carpal bones forming the walls and floor and the flexor retinaculum forming the roof of this space. The tendons of nine muscles of the anterior forearm and the median nerve pass through this narrow tunnel to enter the hand. Overuse of the muscle tendons or wrist injury can produce inflammation and swelling within this space. This produces compression of the nerve, resulting in **carpal tunnel syndrome**, which is characterized by pain or numbness and muscle weakness in those areas of the hand supplied by the median nerve.

Classic symptoms of median nerve compression include pain that may be described as burning, numbness, and tingling, which may involve the forearm or entire arm, as it is relative to the sensation of the median nerve. The hand may lose fine motor skills and the ability to grasp and carry things. Being awakened at night with severe arm pain is common, especially if the patient's wrists are bent forward when sleeping.

Carpal tunnel syndrome happens more often in women, and its occurrence increases with advancing age (AAPM&R, 2024). While repetitive use of the hands has made this common with cashiers and assembly-line workers for many years now, keyboard typing has become a common source of the syndrome. There is also a hereditary component to

carpal tunnel syndrome, and as mentioned, position of the wrist (especially flexion) can contribute to the disorder and its symptoms.

PATIENT CONVERSATIONS

Carpal Tunnel Syndrome

Scenario: A 50-year-old female, Mrs. Eldridge, talks to the nurse, LaTonya, prior to a visit with her primary care provider for a painful wrist and thumb.

Nurse: Mrs. Eldridge, how long has this pain been bothering you?

Patient: About three months now.

Nurse: What sort of work do you do?

Patient: Medical coding; I work from home.

Nurse: Nice. That's computer work, right? Lots of typing?

Patient: Oh yes.

Nurse: Let me see your hand. The one that hurts. [pause] I notice the pad at the base of your thumb, it's nearly gone. Has that been three months too?

Patient: Yes, it wasted away.

Nurse: Does the pain ever wake you up?

Patient: Every night, I jump up from a deep sleep shaking my hand, it hurts so much! What's going on with me?

Nurse: Well, the doctor will do a test to be sure, but you might be experiencing carpal tunnel syndrome. At least that's a starting point. The doctor will be in shortly, and we'll have a better idea.

Treatment commonly begins with NSAIDs and a wrist and hand brace, which maintains the wrist in a neutral—not flexed—position, which is especially helpful while sleeping. Patients may also choose to wear the brace during activities that tend to cause pain. Corticosteroid injection may help relieve symptoms, at least temporarily; surgery to enlarge the tunnel by dividing the carpal ligament may be recommended (OrthoInfo, 1995–2023). Postoperatively, patients wear an immobilizing brace.

Disorders of the Feet and Toes

There are some musculoskeletal disorders that are naturally associated with the feet, including toes. These may only occur in connection with the feet, or commonly strike feet and toes, but also have the potential to happen elsewhere. This chapter's exemplars include gout, which can appear in any joint, but is very common in the feet, especially the great toe. Other disorders specific to the feet and toes include pes planus (flat feet), hallux valgus (bunion), and hammertoe.

Gout

A type of arthritis that causes swollen, red, hot, and stiff joints due to the buildup of uric acid is termed **gout** (Figure 25.22). It typically first attacks the big toe. Uric acid usually dissolves in the blood, passes through the kidneys, and is eliminated in urine, but gout occurs when uric acid builds up in the body and forms painful, needlelike crystals in joints.

FIGURE 25.22 This is a great toe with classic signs of gout-related inflammation. (credit: modification of work "Gota" by “John Cush”/Public Domain Pictures, Public Domain)

Gout is treated with lifestyle changes such as avoiding alcohol and food high in purines as well as administering antigout medications, such as allopurinol and colchicine. Nurses are often involved in patient education, and with gout there may be complicated comorbidities, polypharmacy, and diet and exercise teaching to be done to maximize the patient’s care plan. In extreme cases, especially with frequent exacerbations of gout, surgery may be indicated and may involve joint fusion or replacement (Petrie, 2023). Related nursing assessment will be based on location but includes pain assessment and regional focused assessment.

REAL RN STORIES

Patient with Gout

Nurse: Monica, RN
Clinical setting: Home environment
Years in practice: 7
Facility location: Columbus, Ohio

A 58-year-old patient has just been diagnosed with an acute exacerbation of gouty arthritis. He told me this was the third acute episode he has experienced in four months, then said, “Both my big toes hurt so bad!” As I followed up for more information, I found his father is Italian and his mother German. His father worked the family farm, and his mother was a homemaker. His wife is Irish; she works as a receptionist. He is an accountant and sometimes works long hours, especially at tax time; he doesn’t feel he has time to exercise.

I asked about his involvement in his diet, whether he plans meals, shops for groceries, or cooks meals. He told me that when he was single, his mother did all that, and now his wife does. He tells me his father always enjoyed some red wine in the evenings, and he inherited that habit, usually having three to five glasses. When his wife cooks Italian food from his grandmother’s recipes, she is sure to include plenty of cheese, especially mozzarella and parmesan. He told me his wife sometimes packs him a lunch; his favorite is a summer sausage and blue cheese sandwich, with pickles and sauerkraut, but he’ll eat any lunchmeat-and-cheese combination.

I was pretty concerned about his dietary intake and his lack of exercise. Clearly, his habits have been formed over many years and were well established within his family. I thought about the particular foods he enjoys and, of course, the wine. I knew if I criticized him or his family for their dietary choices, he might be resistant to any suggestions I made, especially since his parents are both still alive, and while they are older, the active lifestyles involved with running a farm may have contributed that. But his lifestyle includes very little physical activity, with

excessive food and wine, especially high-purine foods, which are the likely contributors to the rather frequent exacerbations of gout.

I asked him if his wife should join us to talk about food choices and such. He welcomed that idea. With both of them, I outlined foods and beverages that are high in purine and therefore lead to hyperuricemia. I described the pathophysiology of hyperuricemia and its relationship to gout. We talked about some different ways of meal planning. Then I told him he should try to not drink more than two glasses of wine per evening.

That was a huge education session, with a lot of information for both of them. In many cases, it is hard for patients to remember details, so I gave them some written information as well. This included the list of high-purine foods, recommended foods, and some simple recipes for the patient and his wife to try. We scheduled a follow-up appointment in a month to see how he is doing, and whether the new ideas have been successfully incorporated.

Pes Planus (Flat Feet)

Flat feet, termed **pes planus**, is a common foot deformity characterized by the loss of the medial longitudinal arch of the foot (Figure 25.23). Most babies and toddlers have flat feet and develop a normal arch by age 5 or 6 years. Pes planus is often associated with obesity, posterior tibial tendon dysfunction, excessive tension in the area, or tight Achilles tendon or calf muscle (Raj et al., 2023).

FIGURE 25.23 Pes planus, or flat foot, is characterized by the lack of a normal arch. (credit: "Flat foot in proband's sister" by National Library of Medicine, CC BY 2.0)

Symptoms are pain noted in the back, leg, ankle, or foot (Raj et al., 2023). The patient will have a visibly flat foot when weight-bearing and may have an abnormal gait.

Treatment may include prescribed NSAID therapy, foot orthotics, and motion control shoes. Patients with higher weight are given weight loss counseling. Surgery to essentially build an arch by moving tendons and fusing other bones into position is done when other interventions have been unsuccessful.

Hallux Valgus

A **hallux valgus**, or **bunion**, is a bony protrusion on the medial side of the foot, next to the first metatarsophalangeal joint, at the base of the big toe (Figure 25.24). Over time, this causes inward alignment of the great toe, angling it toward the next toe. Bunions can be hereditary, can be caused by certain autoimmune disorders, such as RA, or can be caused by wearing tight, restrictive shoes.

FIGURE 25.24 Bunions cause a deformation of the metatarsophalangeal joint and realignment of the toes. (credit: modification of work "How to Prevent A Bunion from Getting Worse" by Daniel Max/Flickr, CC BY 2.0)

Assessment findings include the deformed joint and toe(s), erythema, edema, presence of calluses, hammertoes, and difficulty walking. The patient may relay pain and numbness in the affected joint. Osteoarthritis and bursitis may result from bunions, with added symptomatology from these disorders added to the bunion itself. Treatments include NSAID therapy, orthotics, well-fitting footwear, and application of ice to the region. Physical therapy and corticosteroid injections may be helpful for some patients. In severe cases, bunionectomy may be surgically performed.

Hammertoe

A **hammertoe** is a deformity where the toe bends at the second joint, causing a hammer-type shape (Figure 25.25). This is most common in the second toe but can also occur in other toes. Women tend to experience hammertoe more frequently than men (Petrie, 2023). Causes include traumatic injury, hallux valgus, arthritis, and poorly fitting shoes. In some cases, hammertoe can be congenital. A corn may be seen on the top of the toe, along with a callus on the sole of the foot. Hammertoe can make it painful to walk.

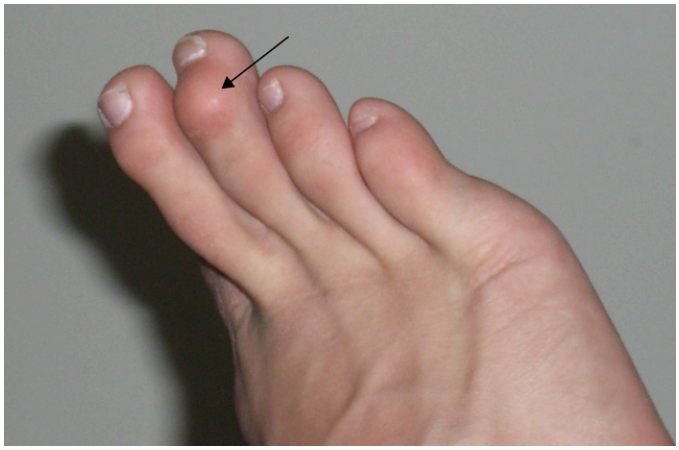


FIGURE 25.25 This is a hammertoe deformity of the second and third toes. (credit: modification of work "Human foot with mallet toe.jpg" by “Bprender22”/Wikimedia Commons, Public Domain)

Physical therapy for specific exercises and taping or splinting the toe straight can prevent the deformity from becoming permanent. Applying an ice pack intermittently, taking NSAIDs, or receiving cortisone injections may help

with pain and inflammation. In some cases, surgery may be required to straighten the toe joint.

Summary

25.1 Structure and Function

The structure and function of the musculoskeletal system has been a focus of this section. Bones, muscles, tendons, ligaments, collagen, and other connective tissue are the major structures of this body system. These interact with the neurological system in order to provide movement. There are five musculoskeletal system functions: structure and support, movement, protection of vital organs, storage and supply of calcium and phosphate, and hematopoiesis.

Under normal circumstances and with normal abilities, the musculoskeletal system is a fine-tuned machine, delivering on its many functions flawlessly. However, with any impairment of the intricate workings of the system, any of the five functions may be affected, with an assortment of potential disorders and diagnoses. Effects may be apparent in both physical and psychological signs and symptoms experienced by the patient.

25.2 Physical Assessment

Nursing assessments are relied on by healthcare teams and patients, in all sorts of settings. Such data provide baseline information as well as ongoing documentation of changes in a patient's status, whether positive changes as the patient heals or otherwise improves or negative and concerning alterations. Assessments may be comprehensive and complete or focused on a particular body system and situation. They are compared and reviewed, and updates are frequently provided to show dynamic and ongoing care. These past paragraphs and pages have explored some general concepts about bedside nurses and assessments, and the musculoskeletal assessment in particular. Additionally, one system does not exist in isolation, so connections as to how this system fits and functions with other systems have also been discussed.

The nursing process initiates nursing care through assessment and on through diagnosis/analysis, planning, implementation, and evaluation. A newer model, the clinical judgment measurement model (CJMM), includes four phases: recognize cues to start the process; analyze cues, prioritize hypotheses, and generate solutions; take action; and evaluate outcomes (National Council of State Boards of Nursing [NCSBN], 2023). As generalist nurses are educated and prepared for practice, nursing programs introduce students to the normal assessment. Nursing education also introduces a multitude of disorders through varied teaching and experiential methods, helping learners to make connections between potential patient presentations and possibilities as to what is happening physiologically. The bedside nurse is typically tasked not with differential diagnosis but with identifying normal findings and recognizing those that are abnormal. Therefore, an introductory look at some abnormalities associated with the musculoskeletal system is included in this section.

Finally, this section offers some details as to frequently expected documentation to be done by nurses. Whether a nursing assistant or the individual nurse has obtained certain assessment data (e.g., vital signs, point-of-care glucose), the RN is responsible for validation of results, typically made by reviewing and acknowledging the information. Healthcare settings have different expectations about documentation, including format and frequency requirements. It is important for nurses to be aware of expectations and requirements, as well as evidence-based best practice, in order to maintain quality care and communication among members of the interdisciplinary healthcare team.

25.3 Recognizing Common Musculoskeletal Disorders

There are certain musculoskeletal disorders that are associated most frequently with particular regions. These include certain diagnoses that are common in the spine; those common to upper extremities, specifically wrists, hands, and fingers; and those typified as ankle, foot, and toe problems. It is important to realize that while some of these are commonly recognized in relationship to one area, they may occur elsewhere. An example is DJD, most commonly OA, which has been explored as both a spinal disorder and that which can occur in other joints.

Several disorders have been exemplified for each musculoskeletal area, focusing on the nursing assessment as the primary angle. Nursing is not practiced in isolation; an interdisciplinary approach is needed for holistic patient care, and some mention of that is included in this section and chapter. Also, drug therapies may need to be incorporated, if briefly, and patient responses to such treatment are assessed as part of nursing care.

Key Terms

ankylosing spondylitis a chronic inflammatory disease primarily of the spine and sacroiliac joint
articular cartilage smooth, white tissue that covers the ends of bones where they come together and allows the bones to glide over each other with very little friction
bone (also, osseous tissue) a hard, dense connective tissue that forms most of the adult skeleton, the support structure of the body
bone marrow the softer connective tissue that fills the interior of most bones
carpal tunnel syndrome pain, numbness, and muscle weakness caused by compression of the median nerve that runs through the carpal tunnel in the wrist
cartilage a semirigid form of connective tissue, provides flexibility and smooth surfaces for movement
cauda equina syndrome a condition of symptoms including loss of bladder or bowel function, increasing leg numbness, and pain
compartment syndrome occurs when increased pressure in a confined body space compromises blood flow to muscles and nerves, causing tissue ischemia
crepitus a popping or crackling sensation when the skin is palpated; it is a sign of air trapped under the subcutaneous tissues
De Quervain tendonitis condition that occurs on the thumb side of the wrist
degenerative joint disease (DJD) (osteoarthritis) the constant cycle of inflammation and joint damage that leads to a loss of the articular cartilage cushion, creating pain, inflammation, and limited joint movement
enthesitis inflammation of the area of attachment of ligament or tendon to bone
flatback syndrome characterized by missing lumbar lordosis of the spine, creating a flat spine
ganglion cyst a fluid-filled lump that most often occurs at the back of the wrist, over tendon sheath or joint
gout a type of arthritis that causes swollen, red, hot, and stiff joints due to the buildup of uric acid
hallux valgus (bunion) a localized swelling on the medial side of the foot, next to the first metatarsophalangeal joint, at the base of the big toe
hammertoe a deformity where the toe bends at the second joint, causing a hammer-type shape
hematopoiesis the production of blood cells
hyperlordosis excessive lordotic curve of the spine
joint the location where bones come together
kyphosis an exaggeration of the curvature of the thoracic spine
ligament band of tissue that connects bones to one another, provides support and stability, and enhances joint movements
lumbar lordosis inward curve above the buttocks
musculoskeletal system composed of bones, muscles, joints, tendons, ligaments, and cartilage that support the body, allow movement, and protect vital organs
ossification bone development
osteoporosis a decrease in bone mass and density that thins and weakens bones causing them to become fragile and break easily
paralysis inability to move
paresthesia loss of sensation, or tingling, in an extremity
passive range of motion the degree of range of motion demonstrated in a joint when the examiner is providing the movement
pes planus (flat feet) a common foot deformity characterized by the loss of the medial longitudinal arch of the foot
pulselessness lack of palpable pulse
red marrow tissue that produces red and white blood cells and platelets; where hematopoiesis takes place
rheumatoid arthritis (RA) a type of arthritis that causes pain, swelling, stiffness, and loss of function in joints due to inflammation caused by an autoimmune disease
scoliosis horizontal curvature of the spine
skeletal muscle produces movement, assists in maintaining posture, protects internal organs, and generates body heat
skeletal system the body system composed of bones and cartilage
skin commensal organism that normally resides on our skin

stenosing tenosynovitis involves the flexor tendons of the fingers and causes the flexor tendons of a finger or thumb to freeze in the bent position
synovial fluid a thick, slimy fluid that provides lubrication to further reduce friction between the bones of the joint
synovial joint has a fluid-filled joint cavity where the articulating surfaces of the bones contact and move smoothly against each other
tendon band of fibrous collagenous tissue that provides a continuation of the muscle sheath to enable muscle attachment to the periosteum of bones
tendonitis inflammation of a tendon
tenosynovitis inflammation of the tendon and the surrounding sheath
yellow marrow tissue that produces fat, cartilage, and bone and contains adipose tissue; the triglycerides stored in the adipocytes of the tissue can serve as a source of energy

Assessments

Review Questions

1. Tendons provide what component of musculoskeletal structure?
   a. joining of two or more muscles
   b. connection of ligaments and muscles
   c. attachment of bone to muscle
   d. linking vertebrae together

2. The hip has what type of joint?
   a. plane joint
   b. saddle joint
   c. pivot joint
   d. ball-and-socket joint

3. A nurse is caring for a 6-year-old child who has a history of bleeding, bruising, and fatigue. The child may have what type of disorder?
   a. electrolyte
   b. bone marrow
   c. cardiovascular
   d. adrenal

4. The new graduate nurse recalls what number of cardinal signs of inflammation?
   a. three
   b. four
   c. five
   d. six

5. A nurse notices a patient's knees creak with bending. This will be documented as what finding?
   a. dislocation
   b. crepitus
   c. impaired ROM
   d. asymmetry

6. An older woman has experienced spontaneous fractures. The nurse associates what disorder as a probable contributor to her bone weakness?
   a. hip dysplasia
   b. scoliosis
   c. sarcopenia
   d. osteoporosis

7. A nurse recommends what action for a patient concerned about sarcopenia-related frailty?

a. reducing protein intake
b. swimming more often
c. thrice weekly stair-stepper
d. high-carbohydrate diet

8. A nurse is caring for a patient who has had surgical repair of a fractured right radius. The nurse notices the right forearm is edematous and firm. What should be the nurse's first action?
   a. Notify the charge nurse immediately.
   b. Call the surgeon about possible infection.
   c. Document the normal findings.
   d. Palpate for a radial pulse.

9. When reviewing a student nurse's planned documentation of a postoperative hip replacement patient, the nurse will reassure the student the CMS assessment includes what item?
   a. bowel sounds
   b. capillary refill
   c. level of consciousness
   d. urinary output

10. The atlas rests on what spinal structure?
    a. spinous process
    b. intervertebral disk
    c. vertebral foramen
    d. second cervical vertebra

11. Flatback syndrome is characterized by a loss of what normal spinal curve?
    a. kyphotic curve
    b. lordotic curve
    c. cervical curve
    d. sacral curve

12. The occurrence of gout is associated with what abnormal laboratory test?
    a. hyperuricemia
    b. hypophosphatemia
    c. hypernatremia
    d. hypomagnesemia

13. Ankylosing spondylitis is an inflammatory arthritic disorder with a potential for causing what diagnosis of the eye?
    a. macular degeneration
    b. retinal detachment
    c. anterior uveitis
    d. astigmatism

Check Your Understanding Questions

1. What musculoskeletal structures are involved in enhancing mobility?
2. Describe abnormal findings that may be found on inspection during a musculoskeletal assessment.
3. Describe the different manifestations of OA and RA, as noted in the hands.
4. Explain the relationship between weight-bearing and the electrolytes calcium and phosphorous in the prevention of osteoporosis.

Reflection Questions

1. Consider the protective function of the musculoskeletal system and a traumatic injury affecting multiple ribs. Compose at least four examples of the potential impacts on underlying organs.
2. Examine at least two possible results a patient may experience from a primary or metastatic neoplasm occurring in the femur.
3. A patient with kyphosis may experience any combination of body image disturbance, self-care deficit, ineffective coping, and acute and/or chronic pain. Compose a nursing care plan and include at least one therapeutic measure for each nursing diagnosis.

What Should the Nurse Do?

1. A nursing instructor is reviewing results of a skeletal quiz taken by a group of second-semester nursing students. A true/false item included the following statement: "The primary purpose of the skull's bony structure is to facilitate movement." Ninety percent of the students selected "true." What should the nurse do?
    a. Score the students' selection of "true" as correct.
    b. Review the protective function of the skull again.
    c. Explain the role of bone marrow in blood cell production.
    d. Review the skull's facilitation of body movement.

2. A patient who has injured the right foot has a weight-bearing prescription for toe-touch weight-bearing. What should the nurse do to position the patient?
    a. The unaffected leg cannot bear weight or touch the floor.
    b. The unaffected toes are on the floor with 25 percent weight on the affected leg.
    c. Both feet are on the floor with up to 50 percent of body weight placed on the affected leg.
    d. Toes of the unaffected leg are on the floor for balance, and no weight is on the affected leg.

3. A 16-year-old patient comes to the clinic because of bilateral foot and ankle pain and states that his mother was told when he started school that he had flat feet. What should the nurse do to assess pes planus?
    a. Have the patient sit in a chair and straighten both feet in the air.
    b. Ask the patient to lie prone and flex both legs at the knees.
    c. Request that the patient stand up with both feet on the floor.
    d. Ask the standing patient to alternate weight-bearing one leg at a time.

Competency-Based Assessments

1. A patient who has had surgical repair of a tibial fracture states, "My leg hurts more now than it did before the pain medicine!" The nurse assesses the leg; what assessment finding further supports the possibility of compartment syndrome?
    a. The leg is warmer than the nonsurgical leg.
    b. The nurse can easily feel pulses on the surgical foot.
    c. The stapled incision is well approximated.
    d. The lower leg is cooler than the upper leg.

2. A nurse explains to a patient that crepitus in the knee when kneeling or squatting is of concern if accompanied by what symptom?
    a. grinding in the knee
    b. pain in the knee
    c. redness of the knee
    d. limited knee ROM

3. Assess another person's feet for pes planus.
4. A patient seeks care for a painful right wrist that is described by burning pain with intermittent numbness and

tingling. The patient is frustrated by dropping items when trying to carry them. The nurse suspects what diagnosis?

a. trigger finger
b. osteoarthritis
c. carpal tunnel syndrome
d. rheumatoid arthritis

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CHAPTER 26

Assessment of the Neurological System

FIGURE 26.1 Nurses guide patients through cognitive exercises in order to assess their neurological health. (credit: "NMCSD recognizes traumatic brain injury month" by Mass Communication Specialist 3rd Class Luke Cunningham/Flickr, Public Domain)

CHAPTER OUTLINE

26.1 Structure and Function
26.2 Physical Assessment
26.3 Recognizing Common Neurological Disorders

INTRODUCTION The neurological system is intricate and complex, and it affects all body functions. Nurses may encounter an altered functioning neurological system in patients among various practice settings. Neurological disorders may occur in anyone at any time and vary from mild to life-threatening. Therefore, it is essential for nurses to understand the neurological system to adequately assess its proper functioning as well as the nursing implications and interventions related to diagnosis and treatment.

26.1 Structure and Function

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify structures of the neurological system
- Recognize functions of the neurological system
- Recall effects of impaired function of the neurological system

The nervous system is the command center of the body. Many of the crucial jobs the nervous system undertakes

happen automatically and regardless of our awareness, like a steady heartbeat and breathing pattern. At the same time, the nervous system is also the seat of our consciousness. It is what allows us to explore the world through our senses, process the input we get from the world around us and learn from it, and feel emotions in response to our experiences.

When the nervous system operates as expected, the body is able to function. However, dysregulation within the nervous system will lead to dysfunction and disturbance in the body, which may have a profound effect on a patient physically and mentally.

The nurse needs to understand the complex anatomy, structure, and function of the nervous system to fully appreciate the value of doing a neurological assessment. During the assessment, the nurse collects subjective and objective data through an interview and detailed physical exam of a patient's central nervous and peripheral nervous systems.

Structures of the Neurological System

The neurological system consists of two parts: the central nervous system and the peripheral nervous system. The nervous system transmits signals between the brain and the rest of the body to control motor, sensory, cognitive, behavioral, and autonomic activities. In other words, the brain is the powerhouse that controls the ability to move, see, breathe, and think. In addition, the nervous system monitors bodily processes and responds to stimuli to maintain homeostasis and direct all physical, physiological, and biological activities.

Central Nervous System

The **central nervous system (CNS)** includes the brain and spinal cord. This nervous system is responsible for receiving, processing, and responding to sensory information. The brain is the organ responsible for sensation, movement, emotions, responses, thought processing, communication, and memory. The spinal cord sends motor commands from the brain to the peripheral body. The spinal cord also relays sensory information from sensory organs to the brain (Thau et al., 2022).

Brain

The major regions of the brain are the cerebrum and cerebral cortex, the diencephalon, the brain stem, and the cerebellum. The largest portion of the brain is the cerebrum (Figure 26.2), and it is composed of the right and left hemispheres, the thalamus, the hypothalamus, and the basal ganglia. The left and right hemispheres are in constant communication with each other but are responsible for different behaviors, this is known as **brain lateralization** (Figure 26.3). The left hemisphere is dominant for logic, language, and mathematical abilities. The right hemisphere is more creative and intuitive and is dominant in musical and artistical situations (Thau et al., 2022). The major communication pathway between the two hemispheres is the **corpus callosum**.

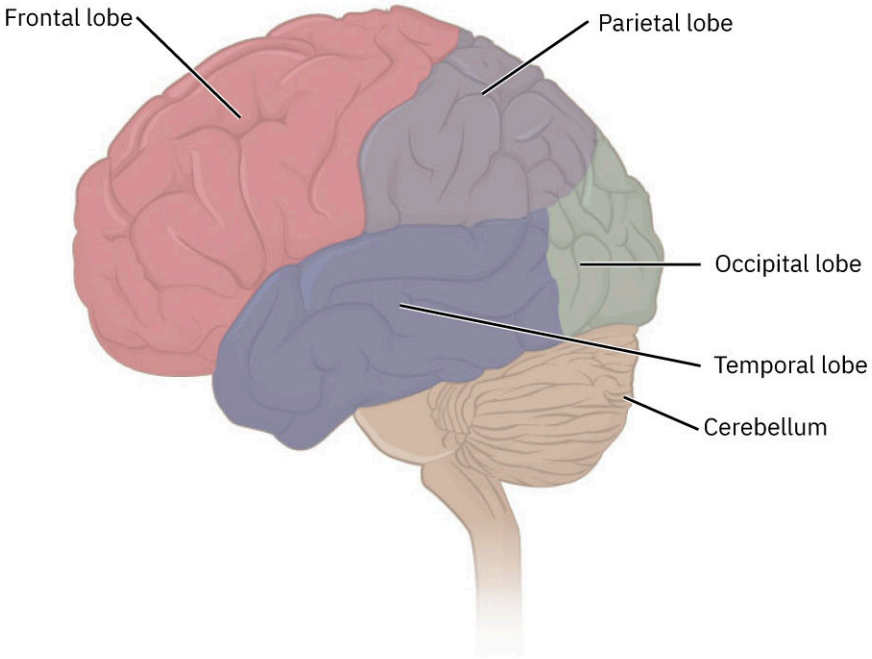


FIGURE 26.2 The cerebellum and the different lobes of the cerebrum. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

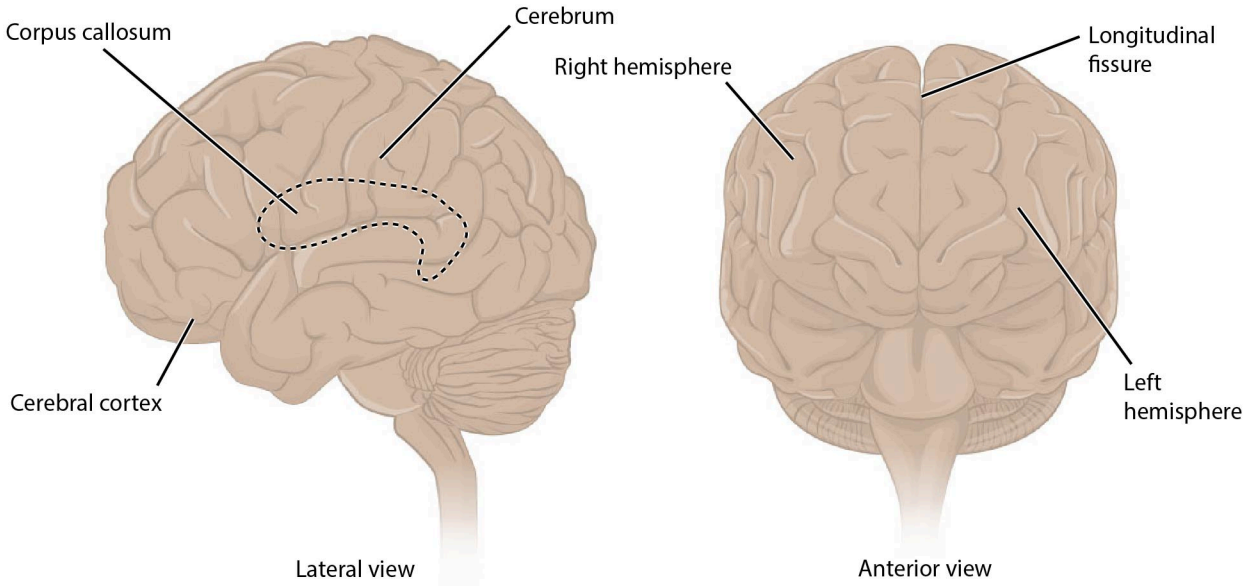


FIGURE 26.3 The left and right hemispheres are connected via nerve fibers. The left hemisphere controls the right side of the body, and the right hemisphere controls the left side of the body. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

The cerebrum is covered by the **cerebral cortex**, a wrinkled outer layer of gray matter. The cerebral cortex is responsible for higher functions such as emotions, memory, and consciousness and is divided into the lobes described in (Table 26.1) (Thau et al., 2022).

Lobe	Location	Function
Frontal	Front of the brain	Concentration, information storage (memory), abstract thought, and motor function. The frontal lobe is also responsible for a person's affect personality, judgment, and inhibitions. Broca's area is located in this lobe and is essential for language and motor control of speech.
Occipital	Posterior to the parietal lobe	Responsible for visual interpretation and memory
Parietal	Posterior to the frontal lobe	Analyzes sensory information and relays the interpretation to other cortical areas, and is essential to a person's body awareness (size and shape discrimination, position in space, and right-left orientation)
Temporal	Inferior to the frontal and parietal lobes	Plays a role in memory of sound and understanding music and language. The auditory receptive areas are also contained in this lobe. Wernicke's area is found here and plays a role in language comprehension (both written and spoken).

TABLE 26.1 Location and Function of the Lobes of the Cerebral Cortex

The **diencephalon**, or the interbrain, contains the hypothalamus and thalamus (Figure 26.4). It acts as a primary relay and processing center for sensory information and autonomic control. The hypothalamus plays a role in the endocrine system by regulating the pituitary secretion of hormones that affect metabolism, stress response, reproduction, and urine production. It also helps regulate homeostasis such as thirst, sleep, hunger, and temperature regulation. Other parts of the hypothalamus play a role in memory and emotion for the limbic system. The thalamus processes, prioritizes, and relays motor and sensory information in collaboration with the cerebellum. The **basal ganglia**, masses of nuclei located in the deep cerebral hemispheres, are responsible for fine motor movements and coordination (Thau et al., 2022).

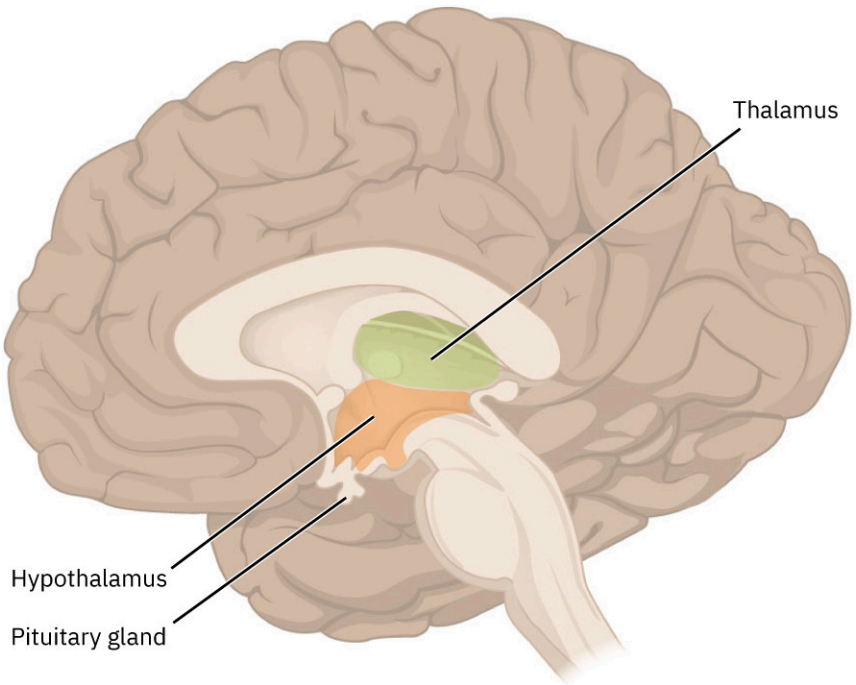


FIGURE 26.4 The diencephalon contains the thalamus and hypothalamus. (attribution: Copyright Rice University, OpenStax, under CC BY

NC-SA 4.0 license)

The brain stem includes the midbrain, pons, and medulla. The midbrain connects the pons and the cerebellum with the cerebral hemispheres. The midbrain also contains motor and sensory pathways and serves as the center for visual and auditory reflexes. The pons, located in front of the cerebellum between the midbrain and the medulla, is the bridge between the two halves of the cerebellum. The pons contains sensory and motor pathways. Portions of the pons help regulate respirations. The medulla contains reflex centers for respiration, heart rate, blood pressure, coughing, vomiting, sneezing, and swallowing. The reticular formation, which is responsible for arousal and the sleep-wake cycle, begins in the medulla and connects with various higher structures.

The cerebellum is located under the cerebrum and behind the brain stem. It is responsible for fine motor movements and coordination. It is also responsible for position (postural) sense or **proprioception**, one's awareness of the position of one's extremities without looking at them. Sensory feedback from the muscles and joints are sent back to the cerebellum to provide that information.

The brain is protected by the skull, meninges, and cerebrospinal fluid. The meninges consist of three layers: **dura mater**, **arachnoid**, and **pia mater**. The dura mater is the outermost layer covering the brain and spinal cord. The arachnoid is the middle layer and contains cerebrospinal fluid in the space below it, also known as the subarachnoid space. The innermost layer is the pia mater. It covers the brain closely and extends into the folds of the brain surface.

Spinal Cord

The spinal cord is an extension of the brain stem (the medulla) from the foramen magnum of the skull to the second lumbar vertebrae; it transmits motor and sensory impulses. The length of the spinal cord is divided into four regions that correspond to the level at which spinal nerves pass through the vertebrae. In descending order, these are the cervical, thoracic, lumbar, and sacral regions. Each region has spinal nerves that innervate specific parts of the body. The spinal cord is protected by bone, meninges, and cerebrospinal fluid.

Neural Pathways

Ascending and descending neural pathways are in communication with the brain. The ascending pathways provide sensory information from the body to the spinal cord prior to reaching the brain. This information travels upward, using first-, second-, and third-order neurons. The first-order neurons send impulses to the spinal cord from the skin and proprioceptors. The second-order neurons then send those impulses to the thalamus and cerebellum. The third-order neurons then send those impulses to the somatosensory portion of the cerebrum. Those sensations include pressure, temperature, pain, and body senses (Thau et al., 2022).

The descending pathways are the communication from the brain to lower motor neurons. The lateral and anterior tracts conduct motor impulses and control voluntary muscle activity. Vestibulospinal tracts are involved in autonomic functions such as involuntary muscle control, sweating, circulation, and pupil dilation. The corticobulbar tract is responsible for impulses that control voluntary and facial movements. Lastly, the reticulospinal and rubrospinal tracts conduct involuntary muscle movement impulses (Thau et al., 2022).

Peripheral Nervous System

The **peripheral nervous system (PNS)** includes the cranial nerves, spinal nerves, and autonomic nervous system. The primary function of the PNS is to connect the CNS to the limbs and organs. Peripheral nerves are categorized as either sensory or motor nerves, or a combination of the two. Sensory nerves transmit impulses from the body to the brain for processing. Motor nerves conduct motor signals from the brain to the muscles to initiate movement.

Cranial Nerves

Cranial nerves are connected immediately to the brain. These nerves are responsible for motor and sensory functions of the head and neck. There are 12 cranial nerves (Figure 26.5) and these are numbered, using Roman numerals, in the order in which they occur from the brain. See Table 26.2 for the cranial nerves and their functions (Cleveland Clinic, 2021).

Nerve	Type	Function
I (olfactory)	Sensory	Sense of smell
II (optic)	Sensory	Sense of vision
III (oculomotor)	Motor	Regulates eye and lid movements, blinking, pupil constriction
IV (trochlear)	Motor	Eye movement (up and down or back and forth)
V (trigeminal)	Both	Corneal reflex, facial sensations, mastication
VI (abducens)	Motor	Eye movement
VII (facial)	Both	Facial expression symmetry; upper and lower facial movement; tearing; salivation; taste; sensations in ear
VIII (acoustic)	Sensory	Sense of hearing, equilibrium
IX (glossopharyngeal)	Both	Taste, swallowing, pharyngeal muscles, sensation in pharynx and tongue
X (vagus)	Both	Homeostatic control of the thoracic and upper abdominal cavity muscles
XI (spinal accessory)	Motor	Shoulder and neck movement
XII (hypoglossal)	Motor	Tongue movement

TABLE 26.2 Cranial Nerves and Function

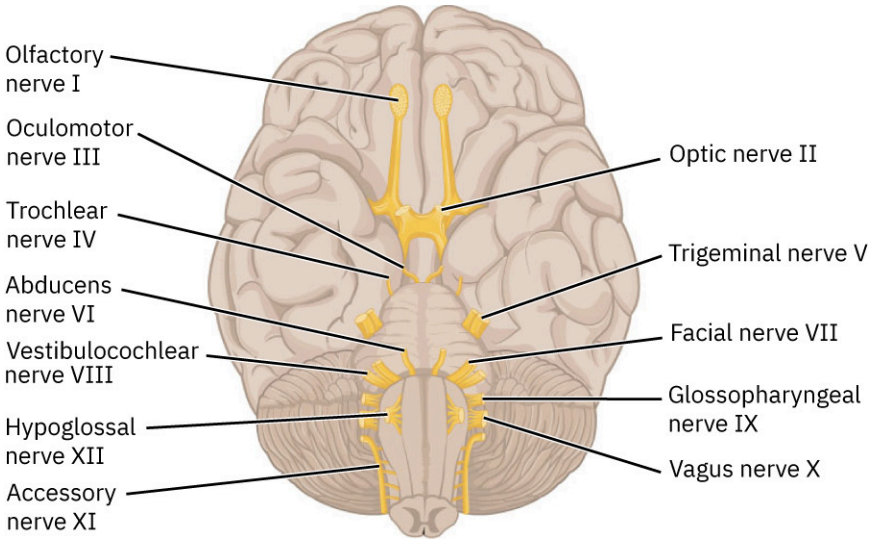


FIGURE 26.5 The 12 cranial nerves originate from the nuclei in the brain and are numbered according to their location in the brain. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Spinal Nerves

Spinal nerves are connected to the brain through the spinal cord (Figure 26.6). There are 8 pairs of cervical nerves, designated C1 to C8; 12 thoracic nerves, designated T1 to T12; 5 pairs of lumbar nerves, designated L1 to L5; 5 pairs of sacral nerves, designated S1 to S5; and 1 pair of coccygeal nerves (Table 26.3). All spinal nerves are

combined sensory and motor nerves. Spinal nerves extend outward from the vertebral column to innervate the periphery while also transmitting sensory information back to the CNS.

Nerves	Location	Function
C1–C5	Cervical	C1: innervation to muscles at base of the skull C2–C3: sensory and motor control for the back of the head C3–C5: phrenic nerve arises here and enables breathing by innervating the diaphragm
C5–C8 and T1	Brachial	Motor and sensory innervation of the upper limbs and upper back
T1–T12	Thoracic	Cutaneous innervation of the viscera, skin, and musculoskeletal system Motor innervation of the thorax, deep back, abdominal wall, and intestines
L1–L5	Lumbar	Innervates the transverse abdominal region to the anterior leg: • L2–L3 nerves provide sensory information to the area they innervate as well as the sex organs • L3–L4 nerves are responsible for generating flexion and adduction of the thighs
L4 and L5 to S1–S4	Sacral	Innervate the gluteal nerves to nerves of the feet

TABLE 26.3 Spinal Nerve Location and Function

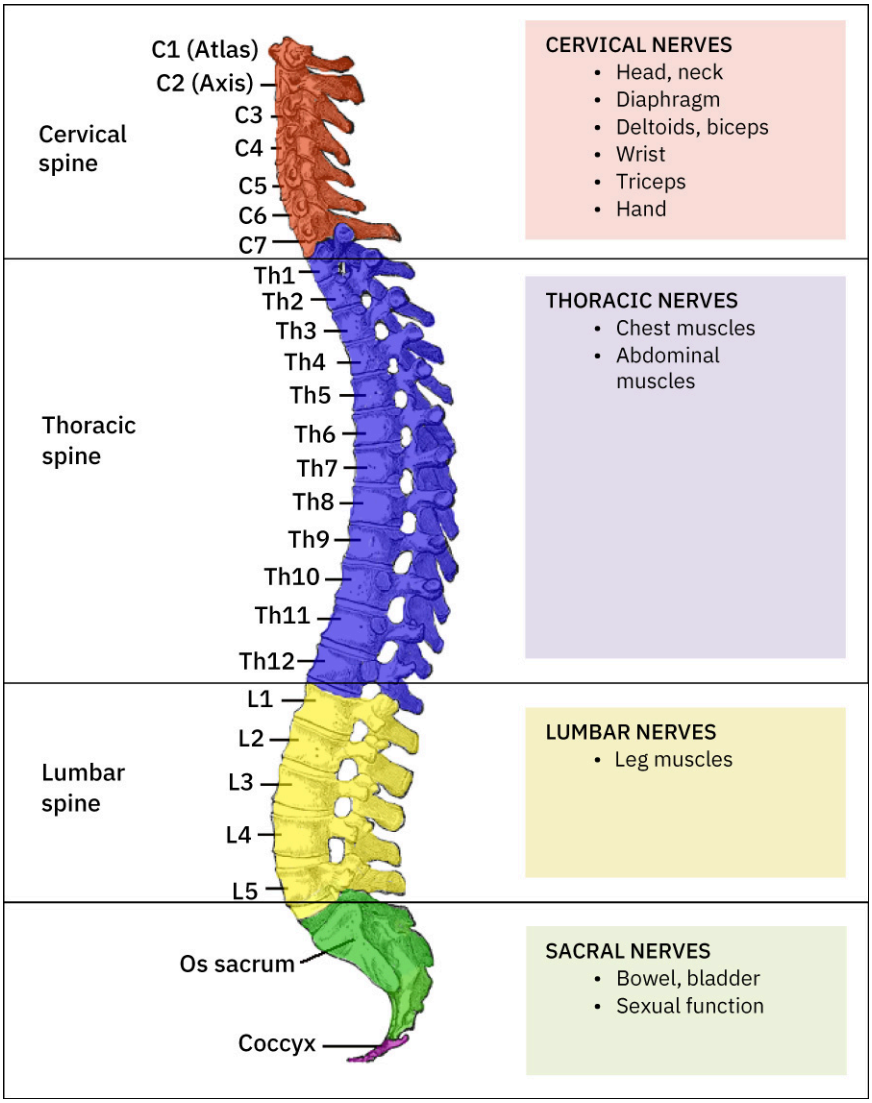


FIGURE 26.6 The spinal nerves are named based on the level they emerge from the spinal cord. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LINK TO LEARNING

Learn more about cranial nerve testing (https://openstax.org/r/77cranialntst) here.

Autonomic Nervous System

The **autonomic nervous system** is a division of the nervous system that regulates the involuntary body functions in order to maintain and restore homeostasis such as physiologic processes of respiration, digestion, blood pressure, and heart rate (Waxenbaum et al., 2024). This nervous system includes internal organs, such as the lungs, heart, blood vessels, digestive organs, and glands. The major divisions of the autonomic nervous system are the sympathetic and parasympathetic nervous systems.

Most organs of the body are **innervated** by the autonomic nervous system. The autonomic nervous system is regulated by centers in the hypothalamus, brain stem, and spinal cord. The hypothalamus links this system with the thalamus, pituitary gland, olfactory apparatus, and the cortex. Visceral and control mechanisms found in this region are essential for defense or attack modes in emotional states, metabolic processes, body temperature regulation, muscular and glandular activities of the gastrointestinal tract, the sleep cycle, and genital function control (Waxenbaum et al., 2024).

Sympathetic Nervous System

The **sympathetic nervous system** is the division best known for the "fight or flight" response. When there is a great emotional response of fear, anger, or anxiety, or even great physical stress, the body responds to sympathetic impulses. These impulses are designed to expend energy to combat trauma, threats, or stressful situations. Table 26.4 lists how parts of the body respond in a "fight or flight" response (Waxenbaum et al., 2024).

Body Structure	Sympathetic Response
Blood vessels	Vasoconstriction
Digestive system	Blood vessel constriction, anal sphincter contraction, peristalsis inhibition
Eyes	Mydriasis (pupil dilation)
Heart	Increased heart rate, increased strength of contraction
Liver	Facilitates breakdown of glycogen to glucose for energy release
Lungs	Bronchodilation
Liver	Facilitates breakdown of glycogen to glucose for energy release
Salivary and lacrimal glands	Decreased secretions
Skin	Vasoconstriction, diaphoresis, arrector pili muscle contraction
Suprarenal gland	Epinephrine (adrenaline) release into the blood
Liver	Facilitates breakdown of glycogen to glucose for energy release
Urinary system	Decreased urine production, bladder sphincter contraction

TABLE 26.4 Sympathetic Responses of Body Structures

Parasympathetic Nervous System

The **parasympathetic nervous system** is the division best known for the "rest and digest" response. This system controls most visceral functions and dominates under nonstressful conditions. The parasympathetic nervous system only innervates the head, viscera, and external genitalia. In general, the structures affected by the parasympathetic nervous system respond in the opposition to how they respond with sympathetic impulses. For example, heart rate and force are decreased, bronchioles are constricted, pupils are constricted, and peristalsis is increased. The key functions of the parasympathetic nervous system promote respiration, digestion, and cardiac relaxation (Waxenbaum et al., 2024).

LINK TO LEARNING

Watch this video to learn more about the autonomic nervous system and the sympathetic and parasympathetic divisions (https://openstax.org/r/77autonersys).

Functions of the Neurological System

The nervous system has a complex and multifaceted role in the body. Each facet of the system is involved in different tasks. However, taking a broader view of its role, one of the most important processes the nervous system plays a role in is communication and information processing. The system not only facilitates communication within the body, between systems, but outside of the body, with the external environment.

The nervous system takes in information about what is happening around the body in the world (sensation) and produces a reaction to that input (motor responses). The process of integration combines sensory perceptions and higher cognitive functions such as memories, learning, and emotion to form a response.

Sensation

We define **sensation** as receiving information about the environment. In humans, the major senses are taste, smell, touch, sight, and hearing. Additional sensory stimuli are also provided from inside the body, such as the stretch of an organ wall or the concentration of certain ions in the blood. Sensation is key for our survival. Think of the importance of being able to feel pain and temperature; for example, we learn quite young not to touch a hot stove because it will burn our hand.

The nurse will encounter patients with various sensory challenges or differences—from vision impairment to hearing loss or even **anosmia** (loss of sense of smell and taste). It is crucial that the nurse not only understands how to assess sensory function but understands how its impairment may affect a patient's ability to function and quality of life.

Response

When the nervous system has taken in the information from the environment that's gathered by the senses, it needs to process it and take action based on what has been perceived. The system will produce a response based on the stimuli perceived by sensory nerves.

For example, withdrawing a hand from a hot stove is an example of a response to a painfully hot stimulus. The sensations of heat and pain are gathered from the external source (stimulus) and processed by the nervous system, and an action is taken in response. In this case, a protective action is taken that helps a person avoid injury (and perhaps teaches them to avoid a danger).

Responses can be voluntary (e.g., contraction of a skeletal muscle) or involuntary (e.g., contraction of smooth muscle in the intestine). An involuntary movement, known as a **reflex**, occur without conscious thought. Voluntary responses are governed by the somatic nervous system, and involuntary responses are governed by the autonomic nervous system.

Breathing, digestion, blood pressure, and heart rate are autonomic responses that the nervous system carries out automatically. Motor responses, like those required to get up from a chair and walk into the kitchen, are intentional, conscious movements.

Integration

The process of integration occurs when stimuli received by sensory nerves are communicated to the nervous system, the information is processed, and a conscious **response** is generated. In this process, the different parts of the nervous system collaborate to make sense of the information and decide what to do with it.

Here's an example: A batter in a baseball game does not automatically swing when they see the pitcher throw the ball. First, they have to consider the trajectory of the ball and its speed, and only then will they start to create the motor response of a swing. Integration will occur as the batter consciously decides to swing (or not). If the count is three balls and one strike, the batter may decide to let the pitch go by in the hope of getting a walk to first base. Or, maybe the batter is afraid to strike out and does not swing. Perhaps the batter is familiar with the pitcher's nonverbal cues and is confident to take a swing at an anticipated fast ball. All these considerations are part of the batter's integration response and the higher-level functioning that occurs in the cerebral cortex.

Effects of Impaired Function of the Neurological System

The neurological system can become damaged by infection, trauma, degeneration, tumors, blood flow disruption, structural defects, and autoimmune disorders. These can have both physical and psychosocial effects on a patient.

Impairments in the nervous system can affect any bodily system and, at times, may affect more than one simultaneously. For example, the global effects of a major stroke can affect a patient's ability to walk, talk, and think. Specific conditions or injuries to bodily systems can affect specific senses, like glaucoma leading to blindness. A severe spinal cord injury may even impair autonomic functions (e.g., respiration). Nervous system impairments that involve the brain can also manifest in a patient's emotional and psychological well-being, causing mood

dysregulation, personality changes, and mental health conditions like depression and anxiety. The nurse needs to be aware of the many ways in which a dysfunctioning nervous system can affect a patient and be equipped to assess effectively for the different problems that can occur, as well as the far-reaching effects they can cause.

Physical Effects

Physical effects of an impaired neurological system include, but are not limited to, dizziness, loss of balance or gait issues, dysphagia (difficulty swallowing), muscle weakness, paralysis, loss of senses, headaches, tremors, seizures, slurred speech, and inabilities to carry out activities of daily living (ADLs). Examples of ADLs include eating, performing personal hygiene, toileting, getting dressed, walking, and transferring (e.g., from bed to chair).

Any damage to the brain, spinal cord, or nerves can greatly affect a person's ability to perform various motor functions. Weakness, paralysis, spasticity, and coordination problems can have a significant effect on a patient's ability to function independently and can lead to complications like falls. Sensory impairments not only affect a patient's quality of life but can put them in danger (e.g., poor vision or hearing may prevent them from hearing or seeing an approaching car when they are walking on the street). Dysfunction of autonomic functions can have a range of effects, depending on the body system affected and the severity of the impairment. For example, dysregulation of blood pressure can lead to orthostatic hypotension, and issues with the body's thermoregulatory system can lead to excessive sweating or feeling constantly cold.

CLINICAL JUDGMENT MEASUREMENT MODEL

Take Action: Safe Patient Environments

When the nurse identifies physical effects of an impaired neurological system, the nurse should promote an environment that aids the patient with performing ADLs as independently and safely as possible. This may include ensuring a gait belt is available for ambulating the patient, ensuring a clutter-free environment to reduce the risk of falling, regular rounding on the patient and assessing for needs while in the room (e.g., call light in reach, toileting needs, items patient want are in reach, bed alarm is on), food changes if needed due to dysphagia (e.g., pureed, mashed, soft, liquid), signage reminding patient to call when they want to get up, and dressing tools (e.g., shoe horn, sock aid). A crucial component the nurse should include in the plan of care is to educate the patient about these interventions and their importance. Those with cognitive effects may need to be reminded or have signs posted in their room as well. The family, if present, should also be aware of these interventions to help promote patient safety as well.

Psychological Effects

Psychological effects of an impaired neurological system include, but are not limited to, depression, changes in cognition or mental ability, fear of losing control, and anxiety. Depression can be due to damage or impaired functioning of the nervous system or due to the physical or psychological effects of an impaired nervous system. Cognitive impairments affect a person's ability to pay attention, make decisions, have sound judgment, speak and understand language, plan, reason, perceive things or ideas, and recall memories. This can contribute to depression and anxiety if the person is able to make the connection that they have lost a function they previously could perform. Fear of losing control and anxiety are common symptoms of cognitive impairments.

26.2 Physical Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Perform a comprehensive neurological assessment
- Understand abnormalities identified during the assessment of the neurological system
- Recall proper documentation of neurological assessment

The neurological exam is a clinical assessment of the functioning of the CNS and PNS. Routine neurological exams performed by registered nurses during their daily clinical practice include assessing mental status and level of consciousness, pupillary response, motor strength, sensation, and gait. The Glasgow Coma Scale (GCS) is also frequently used to objectively monitor level of consciousness in patients with neurological damage such as a head injury or cerebrovascular accident, or stroke (Figure 26.7). Periodic reevaluations are performed when the patient

has experienced an acute injury or illness causing neurological deficits, such as a stroke, which require frequent monitoring for change in condition.

Comprehensive Neurological Assessment

The comprehensive neurological assessment requires the nurse to collect both subjective and objective data through an interview as well as a detailed physical exam. This exam is more extensive and performed on patients with a neurological concern. In addition to the components included in a routine neurological exam, the examiner may also assess cranial nerves, detailed cerebellar function, deep tendon reflexes, and complete a Mini-Mental State Exam (MMSE).

Subjective Data

The subjective data are collected during an interview and guide the focus of a physical exam. It is crucial that the nurse collects a complete health history using effective communication to identify any current or potential issues, because some issues may only be identified through precise questioning during the interview. For example, the nurse will want to ask questions regarding loss of sensation, loss of concentration, or dizziness to identify potential problems (Table 26.5). Follow-up questions may also be required to identify when a patient's symptoms started and any associated signs. The nurse may also ask about other signs and symptoms such as headaches, seizures, confusion, vertigo, recent injury, numbness, tingling, weakness, **dysphagia** (difficulty swallowing), **dysphasia** (difficulty speaking), or loss or coordination.

Interview Questions	Follow-up
Are you experiencing any current neurological concerns such as headache, dizziness, weakness, numbness, tingling, tremors, loss of balance, or decreased coordination? Have you experienced any difficulty swallowing or speaking? Have you experienced any recent falls?	If the patient is seeking care for an acute neurological problem, use the PQRSTU method to further evaluate their chief complaint. Note: If critical findings of an acute neurological event are actively occurring, such as signs of a stroke, obtain emergency assistance according to agency policy.
Have you ever experienced a neurological condition such as a stroke, transient ischemic attack, seizure, or head injury?	Describe the condition(s), date(s), and treatment(s).
Are you currently taking any medications, herbs, or supplements for a neurological condition?	Please describe.

TABLE 26.5 Interview Questions for Subjective Assessment of Neurological System

PATIENT CONVERSATIONS

The Older Adult and the Nervous System Interview

Scenario: A nurse is collecting subjective data about a 79-year-old male in the clinic.

Nurse: Hi. My name is Suzie, and I'm the nurse who will be taking care of you today. May I have your name and date of birth?

Patient: My name is Fred Reid, date of birth January 21, 1944.

Nurse: Great, thank you. What brings you in today?

Patient: I am just here for a check-up. I have been feeling off lately.

Nurse: Okay, can you describe for me what that means?

Patient: Well, I have just been dizzy some.

Nurse: Do you feel light-headed also, and do you notice if it occurs with a particular activity or when you change positions?

Patient: Mainly when I stand up. I start to lose my balance some.

Nurse: When did this start?

Patient: Oh, maybe a week or so ago.

Nurse: Have you experienced any recent falls or medication changes?

Patient: No falls yet. That is why I am here, so I can try to figure this out and not fall. I did get started on Lasix about 10 days ago.

Nurse: Okay, a common side effect of Lasix is called orthostatic hypotension. It is a condition where your blood pressure can lower suddenly when standing from a seated or lying position. It can cause light-headedness or a loss of balance. It is important for you to change positions slowly. So, for example, when you are getting out of bed, you'll want to sit up on the side of the bed and wait a minute or so before standing up to give your body time to adjust to the position changes. You will want to make sure you feel steady before moving, so even if it takes you a few minutes to get your bearings, that is okay.

Patient: Oh, that makes sense.

Nurse: Yes sir. I will let Dr. Caldwell know, and he may order additional testing regarding this while you are here.

Patient: Okay.

Nurse: Have you experienced any other neurological signs or symptoms, like difficulty swallowing or speaking, seizures, headaches, numbness, tingling, or tremors?

Patient: No ma'am.

Nurse: Okay, we will review your other body systems and then move into a physical exam if you are ready.

Scenario follow-up: Now that the nurse has completed the nervous system assessment, they can move on to the other body systems.

Objective Data

The objective data collected during an exam are used to assess the patient's mental status as well as motor and sensory function, cranial nerve function, and deep tendon reflexes. In addition, this part of the comprehensive exam will require the nurse to observe the patient's posture, ability to walk, and personal hygiene, as well. Table 26.6 describes common objective exams used to evaluate various components of the nervous system.

Test	What It Assesses	How to Perform
Glasgow Coma Scale	Mental status/ level of consciousness	Scoring tool that assesses eye opening response, verbal response, and motor response (Figure 26.7).
National Institutes of Health Stroke Scale	Neurological function (mental status, ability to communicate, motor function)	Tool used to assess for suspected cerebrovascular accident. Uses the mnemonic "BEFAST": **B**: Balance (Is there a sudden loss of balance?) **E**: Eyes (Any loss of vision in one or both eyes?) **F**: Face (Does the face appear uneven, is there any drooping?) **A**: Arm (Any weakness or numbness in either arm?) **S**: Speech test (Any slurred speech or trouble speaking? Does patient appear confused?) **T**: Time to call for immediate assistance
Mini-Mental State Exam	Cognitive status	30-point test used to assess for **dementia** (chronic, irreversible confusion) or **delirium** (acute, reversible confusion that may be due to an infection, fever, or lack of oxygen). Scoring is as follows: 24–30, no impairment; 18–23, mild cognitive impairment; and <18, severe cognitive impairment.

TABLE 26.6 Common Tests of the Nervous System

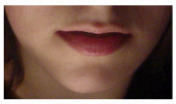
Glasgow Coma Scale		
Behavior	**Response**	**Score**
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response 	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score	Best response	15
	Comatose client	8 or less
	Totally unresponsive	3

FIGURE 26.7 The GCS is a scoring tool used to assess a person's level of consciousness. A score of 15 or higher is rated as the best response, less than 8 is rated as comatose, and 3 or less is rated unresponsive. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

LINK TO LEARNING

You can see the full text of the MMSE (https://openstax.org/r/77MMSE) and see the types of questions for which patients earns points for each correct response. For example, the first question asks five things, so the patient would get a point for each correct answer.

Cranial Nerves

Cranial nerve assessment is also a part of an objective assessment. The nurse should remember to compare each side of the face when assessing each cranial nerve. The cranial nerves can be assessed as followed in Table 26.7.

Cranial Nerve	How to Assess
I (olfactory)	Ask the patient to identify a smell with their eyes closed, such as an alcohol swab or coffee. (credit: “Cranial Exam Image 11” by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

TABLE 26.7 Cranial Nerve Assessment

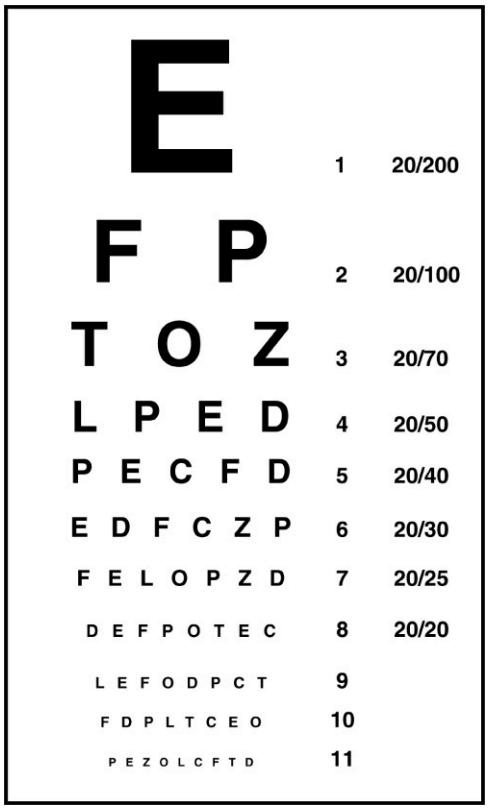
Cranial Nerve	How to Assess
II (optic)	The Snellen chart assesses far vision. The patient should cover one eye and read the letters from the lowest line they can from 20 feet away. The patient may use glasses or contact lenses. The nurse will need to document the results as “corrected vision.”  (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

TABLE 26.7 Cranial Nerve Assessment

Cranial Nerve	How to Assess
III, IV, and V (oculomotor, trochlear, and abducens)	These nerves are tested together using the acronym PERRLA (pupils are equal, round, and reactive to light and accommodation). This is done as follows: • Pupils are tested for movement with a penlight. The patient should follow the light only with their eyes. Any involuntary shaking of the eye is an abnormal finding and is called **nystagmus**. • The pupils should be equal, round, and reactive to light. Both pupils should be compared. The diameter generally falls between 2 to 5 millimeters. Abnormal findings may be pinpoint pupils, which are associated with respiratory depression or coma. • Test the reaction to light by shining the light directly in one pupil coming from the side. The pupil should constrict. Repeat on the other side and assess for the same reaction. An abnormal finding would be if one pupil is larger than the other or responds more slowly than the other. (credit: "Cranial Exam Image 1" and "Pupillary Exam image 1" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0) • Test for convergence and accommodation by assessing the patient's ability to adjust from near to far vision (**accommodation**) and the action of the eyes moving inward to focus with near vision (**convergence**). This is done by having the patient look at an object 4–6 inches away and then moving the object to 12 inches away. The pupils should be constricted while using near vision and dilated while using far vision.

TABLE 26.7 Cranial Nerve Assessment

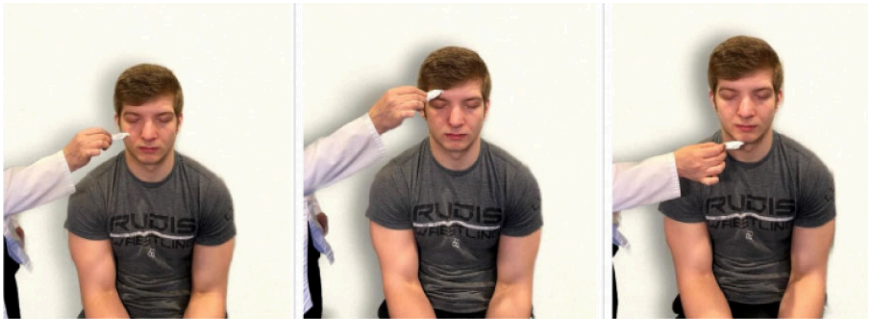
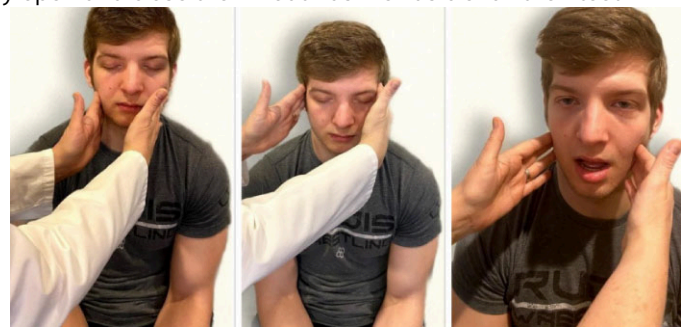
Cranial Nerve	How to Assess
	(credit: “Cranial Nerve Exam 8” and “Cranial Nerve Exam image3” by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)
V (trigeminal)	Test the patient’s sensory function by lightly touching their face, forehead, and chin with a wisp of a cotton ball while the patient’s eyes are closed. The patient should feel each touch.  (credit: “Neuro Exam Image 28”, “Cranial Exam Image 14”, and “Neuro Exam Image 36” by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0) Test the patient’s motor function by palpating the temporalis of the masseter muscles for strength while the patient is clenching their teeth. The patient should be able to symmetrically open and close their mouth as well as clench their teeth.  (credit: “Cranial Exam image 11”, “Neuro Exam Image 35”, and “Neuro Exam Image 4” by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

TABLE 26.7 Cranial Nerve Assessment

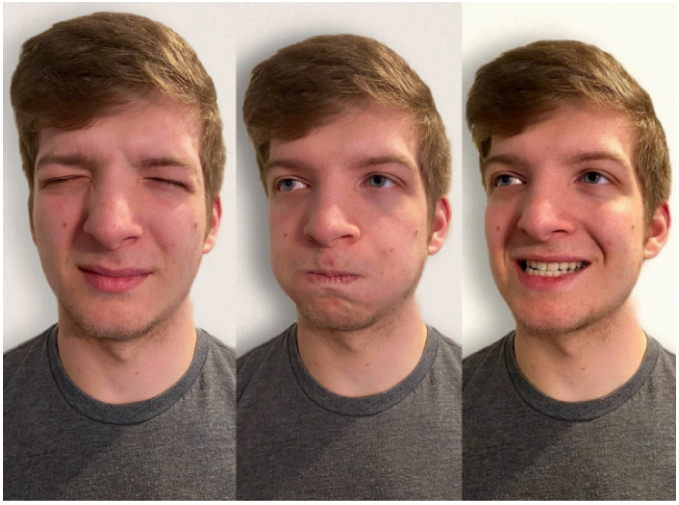
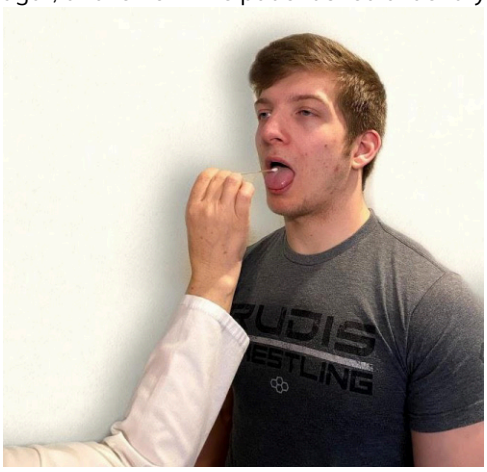
Cranial Nerve	How to Assess
VII (facial)	Test motor function and assess for symmetry and facial muscle strength while the patient smiles, shows teeth, closes both eyes, puffs their cheeks, frowns, and raises eyebrows.  (credit: "Cranial Exam image 15.png", "Cranial Exam image 7.png", "Cranial Exam Image 10.png" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0) Test sensory function by having the patient taste separate cotton applicators that are moistened with salt, sugar, and lemon. The patient should identify each correctly.  (credit: "Neuro Exam Image 17.png" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

TABLE 26.7 Cranial Nerve Assessment

Cranial Nerve	How to Assess
VIII (vestibulocochlear)	Test auditory function by whispering at an arm length's away. Each ear should be tested individually while the patient occludes the ear not being tested. The nurse should exhale and use as quiet of a voice as possible while whispering a combination of letters and numbers (e.g., 3-R-5). The patient should be asked to repeat what they heard. A patient is considered passing if they answer three of the six correctly. If the patient does not respond correctly, the nurse should test again but using a different sequence of letters and numbers. The opposite ear should be testing using a different sequence also. (credit: "Whisper Test Image 1.png" By Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0) Test balance by using the Romberg test. This test is used to assess balance by having the patient stand with their feet together and eyes closed. The nurse must stand by in case the patient begins to fall. The patient should be able to stand erect and maintain their balance. A positive test occurs if the patient sways or loses their balance.

TABLE 26.7 Cranial Nerve Assessment

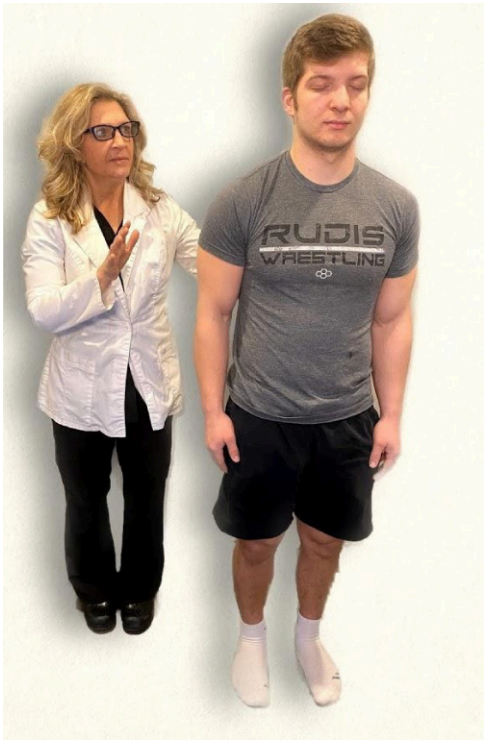
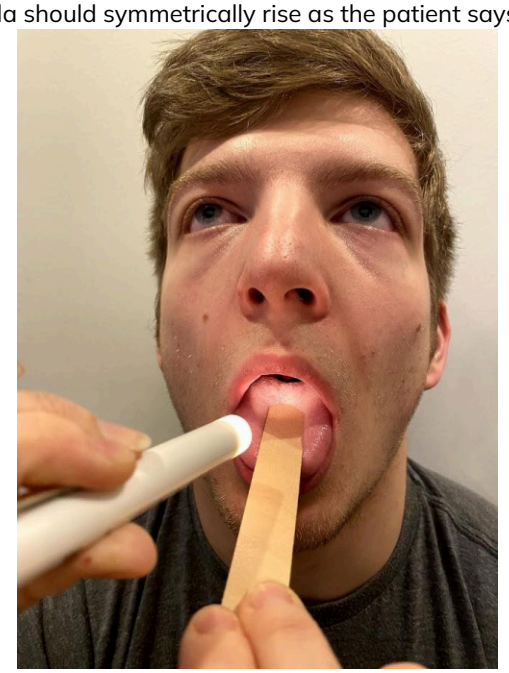
Cranial Nerve	How to Assess
	 (credit: "Neuro Exam image 9.png" by Meredith Pomietlo/Chippewa Valley Technical College is licensed under CC BY 4.0)
IX (glossopharyngeal)	This nerve is assessed by asking the patient to open their mouth and saying "Ah." The nurse assesses the symmetry of the upper palate. The tongue and uvula should be midline, and the uvula should symmetrically rise as the patient says "Ah."  (credit: "Oral Exam Image 2.png" by Meredith Pomietlo/Chippewa Valley Technical College is licensed under CC BY 4.0)

TABLE 26.7 Cranial Nerve Assessment

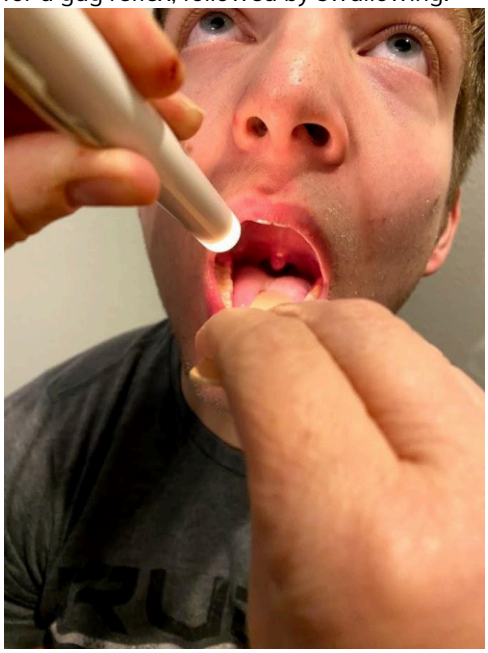
Cranial Nerve	How to Assess
X (vagus)	This nerve is assessed by using a cotton swab or tongue blade to touch the posterior pharynx and observe for a gag reflex, followed by swallowing.  (credit: “Oral Exam.png” by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

TABLE 26.7 Cranial Nerve Assessment

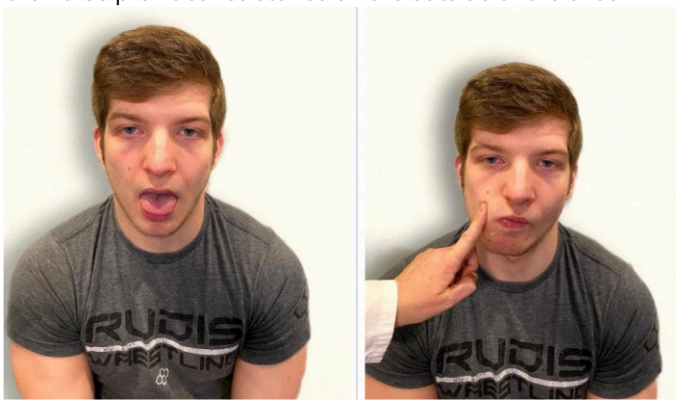
Cranial Nerve	How to Assess
XI (spinal accessory)	• To assess the spinal accessory nerve, the nurse will test the right sternocleidomastoid muscle by facing the patient and laterally placing their right palm on the patient's left check. The nurse will then ask the patient to turn their head to left while resisting pressure from the nurse's hand on their cheek. The nurse will then repeat this on the other side. • The sternocleidomastoid muscle is further assessed by the nurse placing the hand on the forehead of the patient and pushing backward while asking the patient to push forward. • The trapezius muscle is assessed by asking the patient to face away from the nurse while the nurse observes the shoulder contour for displacement, winging, or hollowing as well as any shoulder drooping. This is then followed by the nurse placing their hands on the patient's shoulder while the patient shrugs and retracts their shoulders. (credit: "Neuro Exam image 10" by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)
XII (hypoglossal)	The hypoglossal nerve is assessed by examining any unilateral weakness while the patient protrudes their tongue or by having the patient touch their cheek with their tongue while the nurse provides resistance on the outside of the cheek.  (credit: "Cranial Nerve Exam Image 9.png" and "Cranial Nerve Exam image 11.png" by Meredith Pomietlo/ Chippewa Valley Technical College is licensed under CC BY 4.0)

TABLE 26.7 Cranial Nerve Assessment

LIFE-STAGE CONTEXT

Age-Related Changes to Senses

Nurses should be aware of normal age-related changes that can affect a neurological exam. Part of the normal age-related changes is changes to the senses: vision, hearing, tasting, smelling, and touch. As individuals age, the vision becomes slower due to the elasticity loss of the lens. Older adults also have trouble focusing their eyes and their pupils get smaller. The change in pupil size leads to the lens thickening and becoming less transparent, which ultimately results in a reduction of light reaching the retina. Another common visual a change is the loss of near-vision. Cataracts and glaucoma are common in older adults as well. Hearing loss may occur due to injury, genetics, medications, or exposure to repetitive loud noises or other damaging factors over time. Taste and smell are affected due to less saliva being produced, a decrease in the number of taste buds, mouth diseases, and the overall less ability to differentiate sweet and sour tastes. The sense of touch may be altered due to a condition, lack of blood flow, arthritis, or sedentary lifestyle.

Deep Tendon Reflex

Assessment of reflexes is not typically performed by registered nurses as part of a routine nursing neurological assessment of adult patients, but it is used in nursing specialty units and in advanced practice. Spinal cord injuries, neuromuscular diseases, or diseases of the lower motor neuron tract can cause weak or absent reflexes. To perform deep reflex tendon testing, place the patient in a seated position. Use a reflex hammer in a quick striking motion by the wrist on various tendons to produce an involuntary response. Before classifying a reflex as absent or weak, the test should be repeated after the patient is encouraged to relax, because voluntary tensing of the muscles can prevent an involuntary reflexive action.

Reflexes are graded from 0 to 4+, with "2+" considered normal:

- 0: absent
- 1+: hypoactive
- 2+: normal
- 3+: hyperactive without clonus
- 4+: hyperactive with clonus (involuntary muscle contraction)

LINK TO LEARNING

Watch this video about a deep tendon reflex exam (https://openstax.org/r/77dptendonrx) to learn more about performing reflex assessments.

Sensory Response

Testing of peripheral sensation begins with examining the response to light touch according to regions of the skin known as dermatomes. A **dermatome** is an area of the skin that is supplied by a single spinal nerve that sends information to the brain for processing. To test the sensory fields, ask the patient to close their eyes and then gently touch the soft end of a cotton-tipped applicator on random locations of the skin according to the dermatome region. Instruct the patient to report "Now" when feeling the placement of the applicator. If a patient is unable to feel the sensation of a cotton applicator, an advanced technique applied to comatose patients is to use ice or even the prick of a pin.

It is not necessary to test every part of the skin's surface during a routine neurological exam; testing a few distal areas with light touch is usually sufficient. In-depth testing is performed when the patient is exhibiting neurological signs or symptoms such as motor deficits, numbness, tingling, and weakness.

Cortical processing that occurs in the cerebral cortex of the parietal lobe is assessed using **stereognosis**, which is the ability to perceive the physical form and identity of a familiar object such as a key or paper clip, on the basis of tactile stimuli alone. Often this is called a monofilament testing, and it is routinely done in primary care. As shown in Figure 26.8, the nurse performs this test by asking the patient to close their eyes and then placing the object in their

hand. The patient can use their finger to move the object around. The nurse will ask the patient to name the object. A different object should be tested in each hand. To perform the stereognosis test, ask the patient to close their eyes; then place a familiar object in their hand and ask them to name it. Each hand should be tested with a different object.

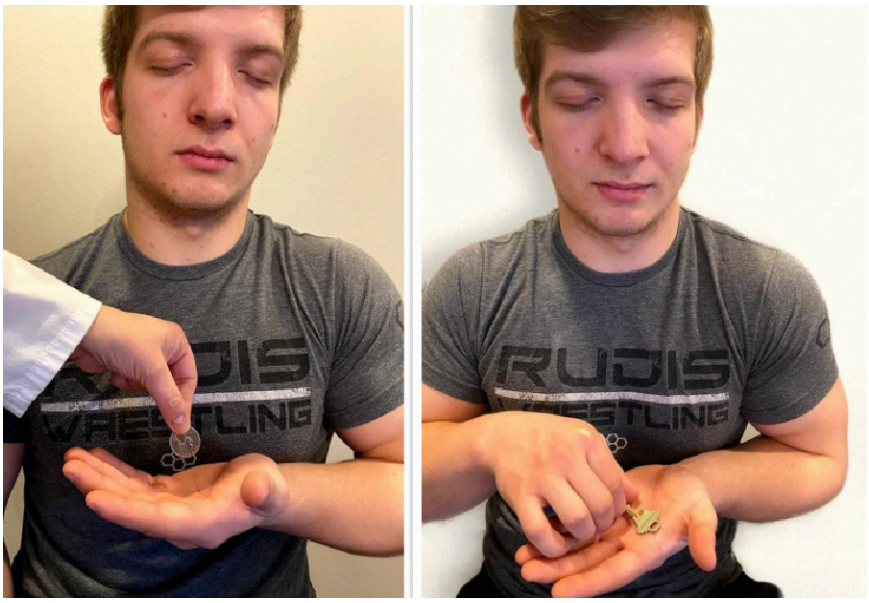


FIGURE 26.8 This test is performed to assess stereognosis, which is the ability to recognize the physical form and identity of a familiar object, such as a key, on the basis of tactile stimuli alone. (credit: "Neuro Exam Image 8.png" and "Neuro Exam Image 31.png," by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

Motor Strength

Motor and coordination functions are also part of the objective assessment. Motor strength is assessed by performing a brief musculoskeletal assessment of the upper and lower extremities. This testing may include hand grasps, upper body strength, and lower body strength. Expected findings of a motor function test is that the patient will have equal strength bilaterally. For the hand grasp test, the nurse should extend two fingers of each hand and have the patient squeeze both hands at the same time. Upper body strength is assessed by having the patient extend their forearms with palms facing upward. The nurse then places their hands on the patient's inner forearms. The nurse asks the patient to pull their arms toward them while the nurse provides resistance.

Lower body strength is assessed while the patient is in a seated position and can be done in multiple ways. The first way is for the nurse to place their hands behind the patient's calves. The nurse will then ask the patient to pull backward with their lower legs while the nurse is providing resistance in the opposite direction. Other tests assess the strength of the patient's lower thighs by having them to lift their legs upward while the nurse provides resistance downward, or the nurse can place their hands on the top of the patient's feet and ask them to pull their toes upward while providing resistance. The feet can also be assessed by the nurse placing their hands on the dorsal part of the patient's feet and asking them to press downward while the nurse provides resistance.

Cerebellar Function

Tests used to evaluate cerebellar function (coordination) include assessment of gait and balance, the finger-to-nose test, and the heel-to-shin test. When assessing gait and balance, as shown in Figure 26.9, the nurse will ask the patient to perform the following actions (using an assistive device if needed): ambulate 10 feet, pivot, and walk back; walk heel to toe while looking straight ahead; walk on their tiptoes; and walk on their heels. An abnormal result occurs if the patient demonstrates any change in gait, shuffling, weakness, jerky movements, loss of balance, or uncoordinated arm swinging.

FIGURE 26.9 The patient's steps should be equal and regularly paced while arms are swinging and coordinated with ambulation, and the balance should also be maintained. (credit: "Neuro Exam image 14.png", "Neuro Exam Image 19.png", "Neuro Exam image 40.png", and "Nero Exam Image," by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

The finger-to-nose test, as shown in Figure 26.10, evaluates equilibrium and coordination. The patient can be in a seated or standing position. The nurse will ask the patient to close their eyes and instruct them to extend their arms outward from the sides of their body. The nurse will then instruct the patient to touch the tip of their nose with their right index finger and return their arm to the extended position. The nurse will then instruct the patient to repeat this motion on the left side. The nurse will also have the patient repeat these steps by alternating arms.

FIGURE 26.10 The expected finding of this test is that the patient will smoothly touch their nose with alternating index fingers and be able to return their arms to the extended position repetitively. If the patient is unable to alternate fingers or touch their nose, then an abnormal result occurs. (credit: "Neuro Exam image.png," by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

For the heel-to-shin test, as shown in Figure 26.11, the nurse will place the patient in a supine position. The nurse will then instruct the patient to place the heel of their right foot just below their left kneecap. The next step is to have the patient slide their right heel in a straight line down to the ankle. The nurse will instruct the patient to repeat this motion on the left leg. An abnormal finding is if the patient is not able to perform the steps in smooth, straight motion or if the heel falls off the lower leg.

FIGURE 26.11 The heel-to-shin test assesses the motor and coordination function. The expected finding is that the patient is able to perform these steps in a smooth, straight movement bilaterally. (credit: "Neuro Exam image 15.png," by Meredith Pomietlo/Chippewa Valley Technical College, CC BY 4.0)

Abnormalities of the Neurological Assessment

There are many abnormalities that can affect the neurological assessment. The most common alterations are altered mental status, altered language, altered nerve function, alterations in sensory function, and alterations in motor and coordination function. The nurse should have a foundation in what is an expected versus an unexpected finding, as well as how to properly perform the assessment to ensure a finding is accurate.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Safety

There are various abnormalities of the neurological system that can exist and affect a patient's safety. It is essential that the nurse performs a thorough assessment of the patient's cognitive, behavioral, and motor functionality to determine safety risks. Individuals are at risk for falls due to any dysfunction in their neurological status, such as a loss of balance or coordination, dysfunctions with gait, confusion related to cognitive impairments, or any impaired sense of position. The nurse should identify risks and implement interventions to promote a safe environment for patients and reduce their risk of falls. For example, a nurse may identify a patient as a fall risk due to an altered mental status and so activate a bed alarm to alert the nurse's station if the patient tries to get up by themselves.

Altered Mental Status

An altered mental status or an altered level of consciousness is present when a patient experiences a change in mental function as a result of a disease or condition affecting the brain. The GCS, as previously described, is the standard tool to assess a person's mental state. This allows the nurse to obtain a baseline to compare against future assessments as well as develop appropriate nursing interventions. Mental status changes can be described as depression, dementia, delirium, and coma.

- Depression: poor cognition test results, slowed speech, personal withdrawal
- Dementia: slow, progressive loss of mental capacity. Idiopathic dementia is a slow loss of memory and orientation, graduating to personality changes, decreased social skills, and inability to perform self-care (Alzheimer disease). Vascular dementia is more fluctuating, with the addition of motor changes along with cognitive decline (Patti & Gupta, 2023).
- Delirium: an acute condition of confusion that can fluctuate from hyperactive to hypoactive states, with periods of lucidity (Patti & Gupta, 2023). Sundowning, or worse delirium at night, is a common phenomenon.
- Coma: inability to respond to normal stimuli but may retain brain stem reflexes (e.g., cough, gag, corneal, pain stimulus, oculovestibular reflexes) (Patti & Gupta, 2023).

LINK TO LEARNING

The Alzheimer's Society provides information on the difference between dementia and delirium (https://openstax.org/r/77infdementia). Families and caregivers sometimes worry that a change in a mental status automatically means dementia. This is a great resource to provide aid in differentiating between the two.

Altered Language

The term **aphasia** refers to a brain disorder in which an individual has difficulty with all forms of communication: expression, understanding, reading, and writing (National Institutes of Health [NIH], 2017). Aphasia can be caused by various conditions but most commonly from traumatic brain injury and stroke. To ensure accurate findings, the nurse should be aware of any devices the patient may need for communication, such as hearing aids or glasses, before performing an assessment.

An altered finding includes speech that is garbled or slurred, the patient struggling to find the right term or word, problems comprehending written or spoken words, or using words that do not make sense in the context of the conversation. If the nurse is unsure of whether altered language is a new change, the nurse should ask the patients family or caregiver about the patient's baseline, if available. New changes could be indicative of a stroke and require early intervention.

PATIENT CONVERSATIONS

Patient Changes in Speech

Scenario: A nurse is assessing a patient who had a stroke 1 week ago.

Nurse: Hi. My name is Kai. May I have your name and date of birth?

Patient: My name is R-r-r-ob Gome. [looks at wife]

Patient's wife: His name is Robert Gomes, date of birth is February 10, 1951. He has been having trouble speaking ever since his stroke.

Patient: [nods his head]

Nurse: Okay, that is actually a common finding. It lasts different lengths for every individual but can take a few weeks to months to see improvement. Mr. Gomes, do you mind if I perform an assessment?

Patient: You can.

Nurse: Okay, can you tell me where you are?

Patient: [garbled] Eagle R-r-ranch.

Nurse: Very good.

[Nurse arranges a pen, her cell phone, and a watch on the table.]

Nurse: Mr. Gomes, I have a few things on the table here. Will you point to the item that is the pen?

[Patient correctly points at the pen.]

Nurse: Very good. Will you describe a hamburger to me?

Patient: [garbled] Yes, there is a patty and bread with ve-veg-tables and must or ma-mayonnaise.

[Nurse holds up a paper with the following sentence: It may rain today.]

Nurse: Will you read this sentence for me?

Patient: [garbled] It m-may r-rain today.

Nurse: Very good. Thank you. Your provider will be in soon to discuss your recent hospital stay, the testing that was performed there, and the review of your assessment.

Patient's wife: Great, thank you. [patient nods his head]

Altered Nerve Function

Cranial nerve deficits can cause pain, numbness, tingling, weakness, or paralysis of the face or eyes. This can be due to nerve damage, poorly controlled diabetes, head injuries, poorly controlled blood pressure, infections, stroke, or tumors affecting the area. Table 26.8 outlines expected versus unexpected findings from a cranial nerve assessment.

Cranial Nerve	Expected Findings	Unexpected Findings
I (olfactory)	Patient is able to identify or describe odor.	Anosmia (inability to identify odors)
II (optic)	Patient has 20/20 vision (near and far).	Decreased visual acuity or visual fields
III (oculomotor)	PERRLA (pupils are equal, round, and reactive to light and accommodation)	Pupil sizes are not equal or reactive bilaterally.
IV (trochlear)	Both eyes follow the examiner's penlight in the appropriate direction.	Patient is unable to follow the penlight with their eyes in the various directions or demonstrates ptosis (eyelid drooping).
V (trigeminal)	Patient is able to feel touch and chew without struggle.	Weakened chewing muscle responses or decreased sensations to touch
VI (abducens)	Eyes move in coordination bilaterally.	Patient is unable to look laterally or has diplopia (double vision).
VII (facial)	Patient is able to smile, raise eyebrows, puff checks, and close eyes without struggle and is also able to differentiate tastes.	Decreased taste sensations, facial paralysis or symmetry (facial drooping)
VIII (vestibulocochlear)	Patient is able to hear whispered words in both ears and is able to walk upright and/or maintain balance.	Decreased hearing in one or both ears; decreased ability to walk upright and/or maintain balance.
IX (glossopharyngeal)	Present gag reflex	Absent gag reflex or dysphagia (difficulty swallowing)
X (vagus)	Patient is able to speak and swallow without struggle.	Slurred speech or dysphagia
XI (spinal accessory)	Patient is able to turn head side to side and shrug shoulders against resistance.	Patient is unable to turn head side to side and shrug shoulders against resistance.
XII (hypoglossal)	Patient's tongue is midline and able to move without struggle.	Patient's tongue is weak or is not midline.

TABLE 26.8 Cranial Nerve Expected versus Unexpected Findings

Alterations in Sensory Function

Alterations in sensory function can be caused by a direct insult to the brain or due to aberrant stress responses, such as trauma, severe illness, acute changes in the environment, and surgery, that cause alterations in neurotransmission. Biochemical imbalances, decreased cholinergic functions, or changes in neurotransmitter levels may contribute to such changes. Age-related changes in neurotransmission and intracellular signaling may also occur and lead to sensory alterations (Khan & Khan, 2022).

Damage to the PNS can cause weakness, numbness, or pain from nerve damage also known as **peripheral neuropathy**. Disorders that may contribute to this sensory alteration include diabetes, autoimmune disorders, metabolic imbalances, smoking, atherosclerosis, nutritional imbalances, kidney or liver disorders, infection, chemotherapy, cancer, and lupus. Types of neuropathies include Guillain-Barre syndrome, diabetic neuropathy, carpal tunnel syndrome, and complex regional pain syndrome.

Alterations in Motor and Coordination Function

Similar to other alterations discussed, there are various reasons for alterations in motor and coordination function. Abnormalities like unsteady gait, abnormal muscle movement, or abnormal posturing can be due to damage to a particular area of the brain, CNS, or PNS in addition to neurodegenerative disorders or neurodevelopmental abnormalities.

When unexpected findings are noted during the motor and coordination function assessment, the nurse should verify any conditions in the patient history that could contribute to the alteration or if this is a new finding. Decreased muscle tone, or **hypotonia**, can occur on its own or is an underlying medical condition, such as muscular dystrophy or cerebral palsy. Hypotonia is often detected at infancy. Increased muscle tone, or **hypertonia**, is caused by damage to the CNS, upper motor neuron lesions, or conditions such as stroke, brain tumors, toxins, neurodevelopmental abnormalities, such as cerebral palsy, and neurodegenerative disorders, including multiple sclerosis or Parkinson disease.

LIFE-STAGE CONTEXT

Motor Changes in the Aging Adult

There are common motor changes in the aging adult that the nurse should be aware of when performing an assessment to determine what may be normal versus a sign of a neurological dysfunction. The following are changes that may be common among the aging adult population:

- A reduction in muscle mass and function can make movements slower or less coordinated, and so may also contribute to a risk of falls.
- A reduction in velocity of contraction and movement can be due to smaller muscle fibers in older adults versus younger adults.
- Abnormal gait may be due to the deterioration of proprioception mechanisms, visual changes, and osteoarthritis.
- Arthritis is common among older adults and can affect all tissues of the joint. This may be painful and have swelling, both of which may lead to the patient having an abnormal gait or reduced movement in the joint.
- Degradation of the synapses of motor nerve and neuromuscular junction is common with aging and causes muscle fiber alterations.

Additionally, older adults may be taking medications that can affect a patient's sense of awareness as well as contribute to dizziness. The nurse should be aware of the medications and supplements the patient takes daily to be aware of any potential side effects or risks.

Validating and Documenting Findings

Documentation is a crucial component to any nursing assessment. This is the baseline information against which future assessments will be compared for evaluation of improving or worsening signs and symptoms. Nursing documentation should include:

- assessment tools used to perform the exam

- detailed findings of each assessment, including any subjective and objective data
- if the practitioner was notified of any abnormal findings, include the name of the practitioner, date and time of notification, and any interventions performed
- any teaching provided to the patient and family, including understanding of the teaching and any follow up teaching needed

Consider the following example. The nurse needs to use a combination of tools to gather subjective and objective data about a patient in the emergency department. The nurse documents that the patient reports "numb feeling" on the left side of their body and that their left arm "feels weak." The nurse notes during the conversation that the patient is struggling to talk, and their speech is difficult to understand. On the motor and sensory components of the exam, the nurse notes the patient's left arm is weak and they have decreased sensation. They note the time of the exam as well as the time that the patient reported their symptoms began. The nurse also assesses and documents the patient's MMSE and GCS scores. In the patient's chart, the nurse documents both the subjective data provided by the patient and the objective data gathered from the exam. Based on what the nurse has observed, they decide the stroke protocol needs to be initiated. The nurse's assessment and documentation are key steps in the diagnostic workflow. From here, the medical team can quickly take next steps to determine if the patient is having a stroke (e.g., ordering a computed tomography scan of the head; laboratory tests) and start treatment (e.g., administering an anticoagulant) as soon as possible. When assessing a patient for a stroke, swift action on the part of the nurse can be critical. Timing is key for stroke diagnosis and treatment, and the nurse's role in conducting a prompt but accurate and thorough neurological assessment is essential.

26.3 Recognizing Common Neurological Disorders

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Examine common cognitive disorders affecting the neurological system
- Recognize common spinal cord disorders affecting the neurological system
- Recall common developmental disorders affecting the neurological system

It is essential that nurses are able to recognize common neurological disorders. This can be done by a proper neurological exam, as previously discussed. The ability to recognize disorders allows the nurse to properly and timely intervene, when necessary, to promote optimal outcomes and quality of life. Neurological disorders may be categorized as cognitive, spinal cord, or developmental disorders. These disorders have various impacts on patients, including pain, seizures, communication and learning difficulties, motor and sensory dysfunction, memory difficulties, and behavior difficulties.

Common Cognitive Disorders

Cognitive disorders are any disorder that affects an individual's cognitive functions, such as how the brain processes and stores information, which affects behavior, memory, communication, learning, perception, problem-solving, and the ability to reason (Dhakal & Bobrin, 2023). Headaches and facial pain can be associated with some cognitive impairment. There are several common degenerative disorders, such as dementia, Alzheimer, Parkinson, and Huntington diseases, and multiple sclerosis; seizure disorders, such as epilepsy; cerebrovascular accidents; and neurological infections.

Headaches and Facial Pain

A headache, or **cephalalgia**, is a common complaint. Headaches range greatly in severity of pain and frequency of occurrence. For example, some patients experience mild headaches once or twice a year, whereas others experience disabling migraine headaches more than 15 days a month. Severe headaches such as migraines may be accompanied by symptoms of nausea or increased sensitivity to noise or light. A headaches that occurs independently and is not caused by another medical condition is referred to as a **primary headache**. Migraine, cluster, and tension-type headaches are types of primary headaches. A **secondary headache** is a headache that is a symptom of another health disorder that causes pain-sensitive nerve endings to be pressed on or pulled out of place. They may result from underlying conditions, including fever, infection, medication overuse, stress or emotional conflict, high blood pressure, psychiatric disorders, head injury or trauma, stroke, tumors, and nerve disorders such as **trigeminal neuralgia**, a chronic pain condition that typically affects the trigeminal nerve on one

side of the cheek.

Not all headaches require medical attention, but some types of headaches can signify a serious disorder and require prompt medical care. Signs and symptoms of headaches that require immediate medical attention include a sudden, severe headache unlike any the patient has ever had; a sudden headache associated with a stiff neck; a headache associated with convulsions, confusion, or loss of consciousness; a headache occurring after a blow to the head; or a persistent headache in a person who was previously headache free.

Degenerative Disorders

Degenerative disorders are those that lead to the increasing deterioration of normal cells or function of the nervous system over time. These disorders affect many activities, like balance, movement, speaking, breathing, cardiac function, and cognitive abilities. Examples of degenerative disorders include dementia, Alzheimer disease, Parkinson disease, Huntington disease, and multiple sclerosis.

Dementia

Dementia is a chronic condition of impaired cognition caused by brain disease or injury and is marked by personality changes, memory deficits, and impaired reasoning. Dementia can be caused by a group of conditions, such as Alzheimer disease, vascular dementia, frontal-temporal dementia, and Lewy body disease. Clinical manifestations of dementia include forgetfulness, impaired social skills, and impaired decision-making and thinking abilities that interfere with daily living. Most dementia cases are irreversible and progressive; however, a small percentage of cases are reversible, such as dementia that results from a removable brain tumor, excessive drug or alcohol use, toxins, infections, autoimmune disorders, subdural hematoma, and vitamin deficiencies (Huang, 2023). Appropriate assessment and nursing care can improve the safety and quality of life for those affected by dementia.

As dementia progresses and cognition continues to deteriorate, nursing care must be individualized to meet the needs of the patient and family. Providing patient safety and maintaining quality of life while meeting physical and psychosocial needs are important aspects of nursing care. Unsafe behaviors put individuals with dementia at increased risk for injury. These unsafe or inappropriate behaviors often occur because the patient has a need or emotion but not the ability to express it, such as pain, hunger, anxiety, or the need to use the bathroom. The patient's family or caregivers require education and support to recognize that behaviors are often a symptom of dementia and/or a communication of a need and to help them best meet the needs of their family member.

Alzheimer Disease

Alzheimer disease is an irreversible, progressive brain disorder that slowly destroys memory and thinking skills and, eventually, the ability to carry out the simplest tasks. It is the most common cause of dementia. In most people with Alzheimer disease, signs and symptoms first appear when the individual is in their mid-60s. One in 10 Americans age 65 years or older has Alzheimer disease (Alzheimer's Association, 2021).

Scientists continue to unravel the complex brain changes involved in the onset and progression of Alzheimer disease. It is thought that changes in the brain may begin a decade or more before memory and other cognitive problems appear. Abnormal deposits of proteins form amyloid plaques and tau tangles throughout the brain. Previously healthy neurons stop functioning, lose connections with other neurons, and die. The damage initially appears to take place in the hippocampus and cortex—the parts of the brain essential in forming memories. As more neurons die, additional parts of the brain are affected and begin to shrink. By the final stage of Alzheimer disease, damage is widespread, and brain tissue has shrunk significantly.

There are 10 symptoms of early Alzheimer disease (Alzheimer's Association, 2021):

- challenges in planning or solving problems
- changes in mood and personality
- confusion with time or place
- decreased or poor judgment
- difficulty completing familiar tasks
- forgetting recently learned information that disrupts daily life
- misplacing things and losing the ability to retrace steps
- new problems with words in speaking or writing
- trouble understanding visual images and spatial relationships

- withdrawal from work or social activities

LINK TO LEARNING

The Alzheimer's Association provides a variety of help and support (https://openstax.org/r/77alzhassoc) for caregivers of those diagnosed with Alzheimer's and dementia. This is a great resource to provide families or caregivers.

Parkinson Disease

Parkinson disease is a slow, progressive disorder that affects movement and eventually leads to death. This disorder most commonly appears in a person's fifth decade of life, although it can occur sooner. Parkinson disease is linked with a reduced level of dopamine that results from the degeneration of dopamine storage cells in the basal ganglia region of the brain. This loss of dopamine affects the voluntary movement, because it is needed for refined motor movements and control.

The signs and symptoms of Parkinson disease have a gradual onset and include tremors, rigidity, **bradykinesia** (slow voluntary movements and speech), postural instability, excessive sweating, drooling, paroxysmal flushing, orthostatic hypotension, urinary retention, constipation, sexual dysfunction, depression, anxiety, dementia, delirium, hallucinations, **hypokinesia** (diminished movement), **dysphonia** (voice impairment), and dysphagia. Those with Parkinson disease may also display a pill-rolling tremor. This appears as the individual is rolling a pill or small object between their thumb and forefinger.

Huntington Disease

Huntington disease is a progressive, chronic, hereditary disease of the neurological system that results in the progression of involuntary movement and dementia. This disease is the result of a genetic mutation involving the Huntington gene (*HTT*). The basic pathophysiology of this disease is associated with premature cell death in the basal ganglia and cells that are lost in the cortex, which ultimately affect movement control, thinking, perception, memory, judgment, behavior, and voluntary muscle activity. This disease typically affects individuals between the ages of 30 and 50.

The clinical manifestations consist of motor, behavioral and psychiatric, and cognitive disturbances. Motor disturbances include unwanted involuntary movements including of distal extremities and possibly the face; hyperkinesia with **chorea** (rapid, jerky, involuntary movements) early in the disease, which progresses into hypokinesia with bradykinesia and dystonia; dysarthria; dysphagia; ataxia; difficulty walking or standing; frequent falls; and the Babinski sign. The Babinski sign occurs when the lateral plantar aspect of the foot is stimulated and results in dorsiflexion of the big toe (Figure 26.12).

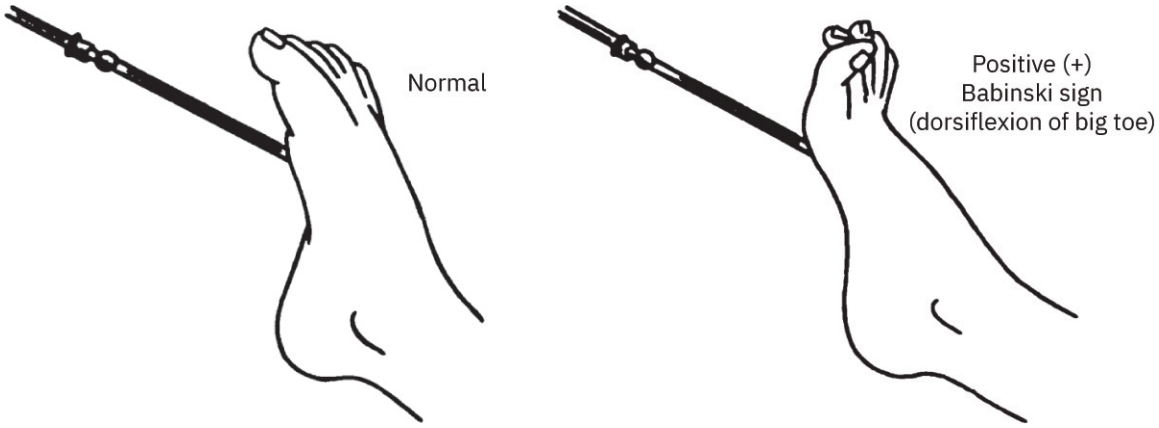


FIGURE 26.12 The Babinski sign occurs when stimulation of the lateral plantar aspect of the foot leads to extension (dorsiflexion or upward movement) of the big toe. Also, there may be fanning of the other toes. (credit: modification of "Lawrence 1960 20.4.png" by Earl Lawrence House and Ben Pansky/Wikimedia Commons, Public Domain)

Behavioral and psychiatric symptoms include poor attention, irritability that can lead to outbursts and aggression, impulsivity, apathy later in the disease, depression, suicidal ideation, psychoses in later stages, lack of awareness,

and a lack of insight into the symptoms the individual is experiencing. Cognitive disturbances include difficulties with organizing, planning, and multitasking; dementia; apraxia; and aphasia. Other features may include weight loss, autonomic nervous system disruption, and sleep disturbances (Ajitkumar & De Jesus, 2023).

Multiple Sclerosis

Multiple sclerosis (MS) is an immune-mediated, demyelinating, progressive disease of the CNS. The term **demyelination** refers to the destruction of the protective myelin that surrounds nerve fibers in the brain and spinal cord that results in impairment of nerve impulse transmissions. The peak onset for this disease is between 20 and 40 years of age. The exact cause of this disease is still an ongoing area of research. The onset and duration of MS may begin over a few days and quickly dissipate, or it may develop gradually over many years. There are four main types: relapsing-remitting MS, secondary-progressive MS, primary-progressive MS, and progressive relapsing MS. Each type varies in the progression of signs and symptoms over time.

- Relapsing-remitting MS comes in the form of attacks, also known as relapse or exacerbation. In this type, those affected recover or return to their usual level of disability in between attacks. Weeks, months, or years may occur between attacks. Periods of disease inactivity are referred to as remission.
- Secondary-progressive MS is usually seen in those who have had a history of MS attacks but then start to develop gradual, steady signs and symptoms and deterioration in their function.
- Primary-progressive MS is less common. It is characterized by increasingly worsening signs and symptoms from the first indication of the disease, with no noticeable relapses or exacerbations. Individuals may experience temporary or minor relief from symptoms.
- Progressive-relapsing MS is the rarest form of MS. It is depicted by a steady worsening of signs and symptoms from the first indication of the disease, with acute relapses that can appear over time during the course of the disease (U.S. Department of Health and Human Services, 2023c).

Early signs and symptoms of MS include visual disturbances like blurriness, diplopia, or optic neuritis (pain with eye movement and rapid vision loss); muscle weakness; muscle stiffness with muscle spasms; balance difficulties; loss of bladder control; dizziness; and tingling, pain, or numbness in the extremities, trunk, or face. Later-stage symptoms may include mental or physical fatigue; mood changes, such as difficulty controlling or expression emotion or depression; and cognitive disturbances, such as difficulties with concentration, learning, multitasking thinking, memory, or judgment (U.S. Department of Health and Human Services, 2023c).

Seizure Disorders

Seizures are sudden, abnormal, excessive electrical impulses in the brain that alter neurological functions such as motor, autonomic, behavioral, and cognitive function. A seizure can be caused by infection, trauma, brain injury, brain tumors, side effects of medications, metabolic imbalances, drug toxicities, and withdrawal from medications.

Signs and symptoms may include a starting episode; convulsive movements with a loss of consciousness; uncontrollable movements to the affected area, depending on the area of the brain it is originating from; dizziness; unusual or unpleasant sensations without a loss of consciousness; incontinence; chewing on tongue; abdominal breathing; and intense rigidity followed by muscle relaxation and contraction (Adamolekun, 2022).

Seizures may be preceded by an aura that consists of paresthesias, abnormal smells, sensation of fear or déjà vu, and epigastric sensation. Most seizures last 1 to 2 minutes and end suddenly. After the episode, a **postictal state** often follows. This state is characterized by deep sleep, confusion, headache, and muscle soreness. This state also varies in duration and can last from minutes to hours (Adamolekun, 2022). Individuals who experience seizures are at risk of hypoxia, vomiting, and aspiration.

Epilepsy

We define **epilepsy** as a chronic brain disorder characterized by recurrent (two or more) seizures that are not related to a reversible stressor and occur more than 24 hours apart. Epilepsy can have an idiopathic (primary) or secondary cause. For example, a secondary cause of a seizure can be a brain tumor.

Seizures can be triggered by a variety of factors, including stress, illness, and lightning. Some patients may experience seizures related to hormonal changes (e.g., fluctuations throughout the menstrual cycle) or due to substance use. Patients who are not able to comply with treatment, such as taking prescribed medications, may experience poorly controlled seizures.

There are several treatment options for epilepsy, including medication and lifestyle adjustments. However, patients may still have seizures and can be at risk for complications as a result. For example, a person who has a seizure while driving could get into a car accident, or a construction worker who has a seizure on the job could be seriously injured. Seizures can also cause emotional, behavioral, and mental health effects, particularly if they affect a person's ability to function and perform in their daily life and relationships.

REAL RN STORIES

Status Epilepticus

Name: Jack, RN
Clinical setting: Community health clinic
Years in practice: 3
Facility location: Suburb outside of Des Moines, Iowa

A few months ago, Shelby, a 45-year-old female who is an established patient at the clinic, came in for a routine follow-up. She was in the waiting room, and I was walking up to the front desk just as the clerk called for help—Shelby was seizing. Since we're a small clinic and she's a familiar patient, I knew that Shelby had a history of epilepsy but that her seizures had been well controlled with medication.

When I got to her in the waiting room, I checked my watch quickly to note the time—just about to turn 8:45 a.m.—then started assessing. She was having a seizure and was nonresponsive. Our desk clerk was quick to call 911, but I knew the local dispatch could be slow to respond because they were understaffed. And the closest ED [emergency department] was still 30 minutes away. In the meantime, one of our other nurses came out with oxygen and we tried to get Shelby's vitals. The provider in the office that day was new and hadn't met Shelby yet, so I had one of the medical assistants go back and fill them in on the situation.

I checked my watch again, and it had been about 5 minutes since Shelby started seizing. She hadn't regained consciousness so I knew it was a more protracted seizure. The other nurse, who was a recent graduate, asked if it's normal for a seizure to last so long. I explained that a prolonged seizure like this style or having multiple back-to-back seizures without regaining consciousness in between them is called status epilepticus and it is serious.

Fortunately, the ambulance crew had been on a nearby call and came in right as I was explaining all this. They were able to transport Shelby to the ED, where they got her seizure under control. It turned out she hadn't been taking her medication because she lost her insurance and couldn't pay for it. She'd been planning to talk to her provider about it at the visit that day.

Cerebral Vascular Accidents (Strokes)

Stroke, also called a cerebrovascular accident, is the sudden loss of brain function due to a disruption of blood supply of the arteries in the brain. Strokes can either be ischemic, due to thrombosis or embolism, or hemorrhagic, due to vascular rupture resulting in bleeding. Stroke symptoms that last less than 1 hour without evidence of cerebral infarction are called **transient ischemic attacks (TIAs)** (Alexandrov & Krishnaiah, 2023).

Contributing factors to the cause of strokes include diabetes, smoking, hypertension, dyslipidemia, obesity, obstructive sleep apnea, sedentary lifestyle, excess alcohol consumption, anticoagulant use, drug use, vasculitis, a high-fat diet, and heart disorders that predispose an individual to emboli, such as atrial fibrillation or myocardial infarction. Other factors include genetics, race, age, and prior strokes (Alexandrov & Krishnaiah, 2023).

Signs and symptoms may come on suddenly and vary depending on the affected area of the brain. Symptoms may include numbness, weakness of face or limbs, confusion, visual disturbances, diplopia, aphasia, loss of balance and coordination, nausea, coma, and headache. Complications can occur in those with history of a stroke and include dysphagia, dysphasia, incontinence, atelectasis, pneumonia, confusion, sleep disturbances, depression, and a decreased ability to perform ADLs (Alexandrov & Krishnaiah, 2023). Bell palsy (Figure 26.13) can often be confused with a stroke.

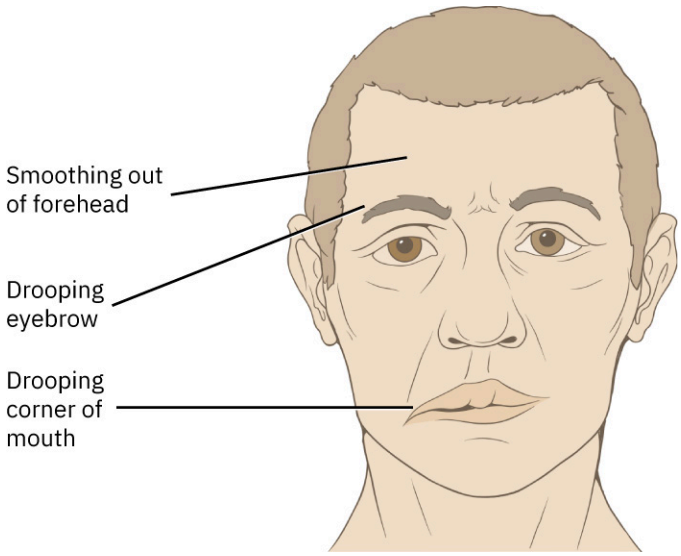


FIGURE 26.13 Bell palsy is a sudden paralysis or weakness in the muscles on one side of the face. It may be caused by swelling and inflammation of the associated facial nerve or a reaction to a viral infection. Signs of Bell palsy include pain in the ear, altered sense of taste, sensitivity to sound, facial weakness, drooling, dry eyes, and drooping of the eyebrow or mouth. Unlike with a stroke, Bell palsy does not present with arm drifts, altered level of consciousness, and unequal pupils. In addition, stroke does not typically result in signs and symptoms such as ear pain or the inability to close the affected eye lid. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

A stroke must be treated as soon as possible, because the longer it goes unchecked, the more damage that can take place in the brain. Depending on the cause and location of the stroke, a patient may need medications to break up clots or prevent clotting, or procedures to remove clots. Medications to lower blood pressure may also be needed. If a patient has a bleed, they may need to discontinue any blood thinners and receive vitamin K. Transfusions may be necessary if the bleeding is severe or occurs during a procedure to remove a clot. Supportive treatment, such as fluids and breathing support, may also be needed depending on the functional status of the patient. For many patients, the period of recovery and rehabilitation after a stroke is intense and can last weeks, if not months.

LINK TO LEARNING

The National Institute of Neurological Disorders and Stroke provides a variety of tools and education (https://openstax.org/r/77NINDS) for healthcare professionals involved in diagnosis and treatment of a stroke. The full stroke scale can be accessed from this site.

The nurse must be able to quickly recognize the signs of a stroke and understand the steps they need to take if they suspect a patient is having a stroke. The acronym BEFAST can be a quick way to assess a patient for the red flag signs and symptoms and key factors of a stroke (Table 26.6):

B: Balance (Is there a sudden loss of balance?)

E: Eyes (Any loss of vision in one or both eyes?)

F: Face (Does the face appear uneven, is there any drooping?)

A: Arm (Any weakness or numbness in either arm?)

S: Speech test (Any slurred speech or trouble speaking? Does patient appear confused?)

T: Time to call for immediate assistance

The nurse also must know their workplace protocol for responding to a patient having or who has had a stroke and be empowered to put this plan into action.

REAL RN STORIES

Assessing for Stroke

Name: Zoe, RN
Clinical setting: Emergency department
Years in practice: Less than 1 year
Geographic location: Ohio

One day I was triaging patients in the ED and a patient presented with facial drooping on one side of his face. Even though I was a new nurse, I knew this was a red flag sign and was concerned the patient could be having a stroke. So, I activated stroke protocol to initiate diagnostic testing and proper assessments. During the assessment, I noted the patient did not have arm drifts or unequal pupils. They were alert and oriented to person, place, and time.

Later, I learned that the imaging for the patient come back clear. I spoke with my charge nurse about the concerns I had and wondered why the patient would be experiencing stroke symptoms and have these negative tests. The charge nurse explained to me that there are other conditions that can present with stroke-like symptoms.

I felt really silly and like I had jumped to conclusions by initiating the stroke protocol, but my charge nurse reassured me that I had done the right thing because it was very important to rule out a stroke. Early intervention is critical for patients who are having strokes, because the longer the brain is deprived of the oxygen and blood supply it needs, the more brain cells will die.

Neurological Infections

Infectious neurological disorders include meningitis, encephalitis, and Creutzfeldt-Jakob disease. Meningitis is the inflammation of the meninges, the protective covering of the brain and spinal cord. This disorder either originates in the bloodstream from other infections or by direct spread. For example, the direct spread may be a result of a traumatic injury to the facial bones. Symptoms include **nuchal rigidity** (stiff, painful neck), a positive Kernig and Brudzinski signs, **photophobia** (light sensitivity), and a rash that ranges from petechiae to large areas of ecchymosis. A positive Kernig sign is when the patient's leg is unable to be fully extended from flexion in a supine position. A positive Brudzinski sign is that when the patient's neck is flexed, the hips and knees flex. Other symptoms may include seizures due to increased intracranial pressure, which can also lead to a decreased level of consciousness.

Encephalitis is inflammation of the brain's active tissues caused by an infection or autoimmune response. A wide range of symptoms may result and can even lead to brain damage, stroke, or death, in extreme cases. Affected individuals may display flu-like signs and symptoms such as fever, fatigue, and headache, as well as seizures, difficulties with movement, anxiety, sensitivity to light and sound, neck stiffness, irritability, hallucinations, loss of consciousness or disorientation, psychosis, memory loss, diplopia, speech or hearing impairments, partial weakness or paralysis in the extremities, impaired judgment, personality changes, and coma (U.S. Department of Health and Human Services, 2023b).

Creutzfeldt-Jakob disease is a rare brain disorder characterized by its rapid progression. This disorder causes rare changes in brain tissue that affects muscle coordination, memory, and thinking. The main signs and symptoms include severe mental deterioration, dementia, **myoclonus** (involuntary muscle jerks), or involuntary muscle movements. Early symptoms in the disease may include vision changes; insomnia or sleep disturbances; confusion; depression; mood swings; impaired thinking, judgment, and memory; walking and balancing difficulties; and lack of coordination. Later-stage signs and symptoms may include weakness in the extremities, loss of ability to speak or move, pneumonia, blindness, and coma (U.S. Department of Health and Human Services, 2023a).

Common Spinal Cord Disorders

Spinal cord injuries include any injury to the vertebral column, supporting soft tissue, intervertebral discs, or the spinal cord itself. Damage may occur due to laceration, transient concussion, laceration, compression of the tissues, or complete **transection** (severing) of the spinal cord. Clinical manifestations vary depending on the area of the spinal cord that is damaged, as shown in Figure 26.14. Spinal cord injuries may lead to **paraplegia**, lower body

paralysis, or **tetraplegia**, paralysis of all extremities. Sensory and motor functions that may be affected range from paralysis (partial or total), loss of bladder or bowel control, pain, loss of sweating and vasomotor tone, blood pressure reduction, and respiratory dysfunction. Types of spinal cord injuries include Brown-Séquard syndrome, central cord syndrome, anterior cord syndrome, and posterior cord syndrome.

Spinal Cord Injuries			
Complete spinal cord injury			
Paraplegia	*Below injury level* LOST: Motor and sensory function	**Tetraplegia**	*Below injury level* LOST: Motor and sensory function
Incomplete spinal cord injury			
Paraplegia	*Below injury level* LOST: Partial motor and sensory function	**Tetraplegia**	*Below injury level* LOST: Partial motor and sensory function
Types of incomplete spinal cord injury			
Anterior cord syndrome	*Below injury level* LOST: Motor function; pain and temperature sensation RETAINED: Touch and vibration sensation, proprioception	**Posterior cord syndrome**	*Below injury level* LOST: Sensory function RETAINED: Motor function
Central cord syndrome	*Below injury level* LOST: Variable sensory function; motor function in upper body RETAINED: More motor function in the lower body than in the upper body, but still impaired	**Brown-Séquard syndrome**	*Below injury level* LOST: Motor strength on one side of the body with sensation loss on the opposite side of the body

FIGURE 26.14 Spinal cord injuries vary depending on the area of the spinal cord that is damaged. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Brown-Séquard syndrome

Central cord syndrome, also called Brown-Séquard syndrome, is caused by a lesion resulting from a transverse hemisection of the spinal cord. This means the spinal cord is transected from north to south. This may be a result of an injury caused by a knife, fracture, or dislocation of a unilateral articular process, or an acute ruptured disc. Characteristics of this disorder include **ipsilateral** (occurring on same side of body) paralysis or paresis; **contralateral** (occurring on opposite side of body) loss of pain and sense of temperature; and ipsilateral loss of pressure, touch, and vibration.

The signs and symptoms of Brown-Séquard syndrome may be evident on a neurological exam and can also be assessed with imaging. There is no cure for the condition, but treatments, including surgery, medication, and physical and/or occupational therapy, can improve a patient's function. The nurse may be involved in assessment of and care for patients with Brown-Séquard syndrome, which can include monitoring, implementing safety protocols (e.g., fall prevention), and providing patient education on medications and self-care.

Central Cord Syndrome

Central cord syndrome is caused by injury or edema of the central cord. This is most commonly found in the cervical region and can be caused by injuries related to hyperextension. This disorder is characterized by sensory loss in the upper extremities, motor deficits in the upper extremities, and dysfunction of bladder or bowel control also may be affected.

Assessment and exam findings paired with imaging to look at specific structures can diagnose central cord syndrome, and the treatment will typically depend on whether the condition responds to conservative care or requires surgery. The nurse's role in care for patients can range from providing support and education to more involved measures like maintaining a patient's airway and taking steps to prevent complications like pneumonia.

Anterior Cord Syndrome

Anterior central cord syndrome may be caused by hyperflexion injuries associated with vertebral fracture or dislocation or acute disc herniation. Characteristics of this disorder include loss of sensations like pain and temperature and loss of motor function below the level of the lesion, whereas the sensations of light touch, vibration, and position remain intact.

Magnetic resonance imaging is typically used to diagnose anterior cord syndrome, and the diagnosis is supported by assessment and clinical exam findings. The nurse may encounter patients with anterior cord syndrome after surgery and provide postoperative care. Specific treatments are related to the cause of the syndrome but can include treating underlying inflammation or surgery to address a structural cause.

Posterior Cord Syndrome

Posterior cord syndrome is a type of incomplete spinal cord injury caused by demyelination disorders, external compression (e.g., from tumors), blockage in a posterior spinal artery, or any lesion to the posterior portion of the spinal cord. This area of the spinal cord is responsible for proprioception as well as sensations of light touch and vibration. Characteristics include sensory ataxia and impaired voluntary movement and coordination.

Clinical assessment and exam findings that the nurse may contribute to can often be used to diagnose posterior cord syndrome. Specific findings, such as sensory deficits, can be important diagnostic clues. The treatment will depend on the cause but can range from supplemental vitamin B12 to correct a deficiency or antibiotics to treat an infection. The nurse's role in management will also depend on the cause and will involve supporting the patient's treatment plan and providing education about the condition.

Developmental Disorders

Developmental disorders vary but include conditions that result in impairment in learning, language, behavior, and movement. These conditions may develop at or during conception or shortly after birth. Many developmental disabilities are caught while the affected individual is young. Developmental and behavioral screenings are performed at well-child visits to assess developmental areas like movement, language, behavior, and thinking skills to identify children at risk for a developmental disorder. These disorders affect the individual throughout their life span. Types of disorders include cerebral palsy, intellectual disability, and prenatal injuries.

The nurse may have the opportunity be involved in early detection of developmental disorders, depending on the patient population they work with. Nurses who treat infants and young children are well positioned to identify developmental disorders, though they can and should assess older patients for them as well. Whatever the age of the patient, the nurse's role in management will involve being part of coordinated, collaborative care that provides treatment and support for the patient based on their needs.

Cerebral Palsy

Cerebral palsy refers to a group of conditions that involve movement difficulties and muscle stiffness. Any muscle malfunction as a result of brain damage after the age of 2 years is not considered cerebral palsy (Victorio, 2023). This disorder often is the result of brain damage from oxygen deprivation, infections, or brain malformations at conception, during pregnancy, or shortly after birth. Characteristics of this disorder range from clumsiness, difficulty moving one or more extremities, ataxia, walking on the toes, paralysis, stiff joints, intellectual disability, failure to thrive, teeth grinding, tremors, speech delays, overactive reflexes, seizures, and visual or hearing disturbances.

Screening and diagnostic testing for cerebral palsy may start with a child's pediatrician or primary care provider, but

a specialist referral is typically an important next step. Brain imaging and genetic testing can be instrumental in making the diagnosis.

The nurse should have a solid grasp of the spectrum of cerebral palsy signs and symptoms and understand that milder cases may not be diagnosed until a child is a few years old. The nurse may encounter patients of all ages with cerebral palsy who have different medical, psychosocial, and developmental needs and levels of support, so a patient-centered approach is key.

Patients with cerebral palsy may need surgery, devices to assist with movement, and physical therapy and speech. Many children with cerebral palsy also receive support at school.

Intellectual Disability

Intellectual disability may be the result of genetics or a disorder that interferes with brain development. Some causes may occur at or before conception, such as chromosomal abnormalities, as with Down syndrome (trisomy 21), Edwards syndrome (trisomy 18), or Patau syndrome (trisomy 13), all of which are associated with intellectual disabilities; or inherited disorders such as Tay-Sachs disease (Sulkes, 2022). Some occur during pregnancy, such as malnutrition, drugs, alcohol, or infections; hypoxia may occur during birth. Other causes include extreme prematurity, poisons, brain infections, malnutrition, severe abuse or neglect, or brain tumors after birth.

Characteristics may vary and include a head that is too large or small; flattened nose; upward-slanting eyes; malformations on the hands (e.g., wide, short hands and fingers; single palmar crease); widely separated first and second toes with increased number of skin creases; decreased muscle tone at birth; small ears or mouth; seizures; lethargy; abnormal urine odor; failure to thrive; abnormal growth; delayed motor skills development; language development delays; behavioral disturbances such as temper tantrums or physical aggression toward themselves or others; anxiety; and depression. Other clinical manifestations may include visual, hearing, cardiovascular, or gastrointestinal problems.

As with other developmental conditions, the nurse working with young patients may be in a unique position to notice signs of potential intellectual disability early and support the appropriate treatment. For example, the nurse may take note of motor or social skills deficits, or signs of specific conditions such as Tay-Sachs disease.

Prenatal Injuries

Prenatal injuries may result in various developmental disorders. The prenatal environment, both external and internal, greatly influence the development of the fetus and later health, including into adulthood. Prenatal injuries can cause neurodevelopment disorders such as autism spectrum disorder, attention-deficit hyperactivity disorder, and fetal alcohol syndrome (FAS) (Doi et al., 2022). Autism spectrum disorder is characterized by delays in language, movement, or learning skills; hyperactivity; seizures; constipation; unusual emotional reactions; interest in only a limited number of things; attention difficulties; apathy; and sensitivity to sounds. Attention-deficit hyperactivity disorder is characterized by constant fidgeting, excessive movement or talking, the inability to sit still, acting without thinking, aggression, impulsivity, and a short attention span. Those affected by FAS may have problems with memory, learning, communication, vision, hearing, or communication. Characteristics of FAS in infants include a flat midface, thin upper lip, short nose, microcephaly, epicanthal folds, upturned nose, and small palpebral fissures (Figure 26.15).

Nurses working with infants, in particular, must be able to recognize these conditions and assess for them. The nurse's role is paramount to ensuring that a child and their family can access the treatment and support they need. Nurses who work with people who are or may become pregnant also need to be well-versed in the risk factors associated with prenatal injuries and be able to offer support and intervention for patients who are at risk.

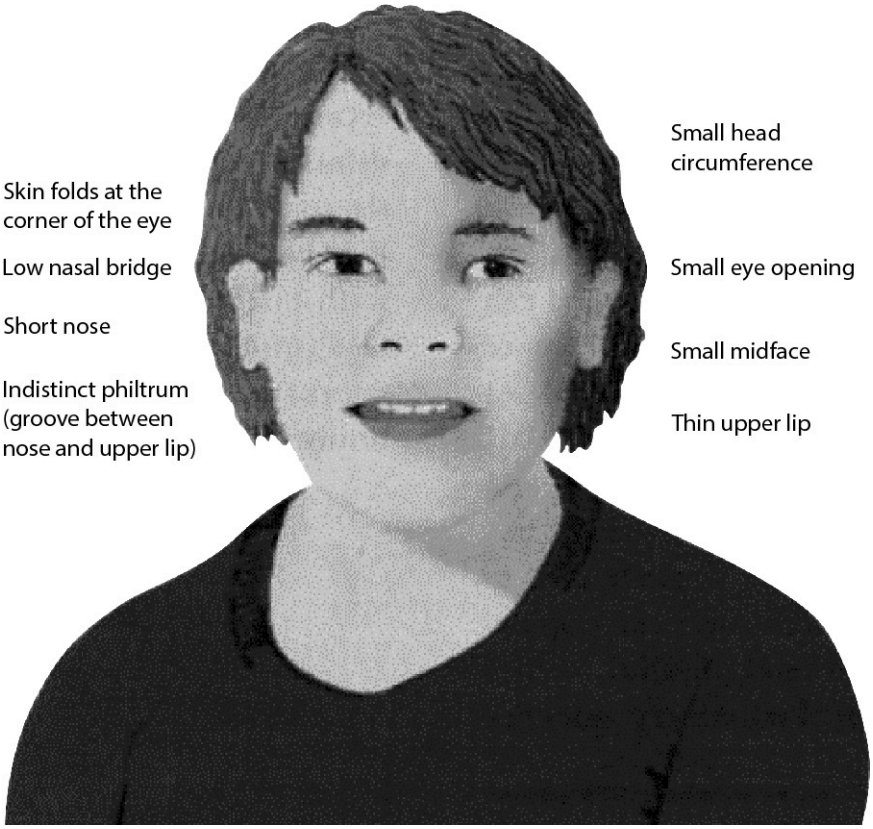


FIGURE 26.15 Fetal alcohol syndrome characteristics include small eye openings, a smooth philtrum, and thin upper lip. (credit: modification of "FASkid.gif" by NIH/ /Wikimedia Commons, Public Domain)

Prenatal injuries also include drug use disorders, stress, toxin exposure (e.g., mercury, pesticides, herbicides, certain cleaning products, lead), malnutrition, and medication use that has not been deemed safe in pregnancy. Intrauterine growth restriction can also lead to injuries due to the placental blood-flow reduction, hypoxemia, and undernutrition. These injuries can also result in prematurity, low birth weight, and failure to thrive (Doi et al., 2022).

Summary

26.1 Structure and Function

The structures of the neurological system include the CNS and PNS. The CNS includes the brain and spinal cord and is responsible for receiving, processing, and responding to sensory information. The brain is the organ responsible for sensation, movement, emotions, responses, thought processing, communication, and memory. The spinal cord sends motor commands from the brain to the peripheral body and also relays sensory information from sensory organs to the brain. The PNS includes the cranial nerves, spinal nerves, and autonomic nervous system. The primary function of the PNS is to connect the CNS to the limbs and organs. Peripheral nerves are categorized as either sensory or motor nerves, or a combination of the two. Sensory nerves transmit impulses from the body to the brain for processing. Motor nerves conduct motor signals from the brain to the muscles to initiate movement. Physical effects of an impaired nervous system include dizziness, loss of balance or gait issues, dysphagia, muscle weakness, paralysis, loss of senses, headaches, and inability to perform ADLs. Psychological effects of an impaired neurological system include, but are not limited to, depression, changes in cognition, fear of losing control, and anxiety.

26.2 Physical Assessment

The comprehensive neurological assessment requires the nurse to collect both subjective and objective data through an interview as well as a detailed physical exam. The nurse will collect a complete health history, using effective communication to identify any issues or potential concerns, because some issues may only identified through precise questioning during the interview. The nurse will also collect objective data to assess the patient's mental status, appearance, motor and sensory functions, cranial nerve function, and deep tendon reflexes. Tests that may be used include, but are not limited to, the GCS, NIH Stroke Scale, MMSE, various cranial nerve assessments, heel-to-shin test, and finger-to-nose test. The nurse should be able to identify expected versus abnormal findings. For example, as part of assessing the patient's orientation, the nurse should recognize a potential alteration if the patient provides an incorrect date. The nurse should also validate and document their findings. The documentation should be comprehensive to provide baseline information for future comparisons.

26.3 Recognizing Common Neurological Disorders

Cognitive disorders are those that affect the cognitive function of an individual, such as how the brain processes and stores information. Cognitive disorders affect behavior, memory, communication, learning, perception, problem-solving, and the ability to reason; and include headaches and facial pain; degenerative disorders such as dementia, Alzheimer, Parkinson, and Huntington diseases, and MS; seizure disorders such as epilepsy; cerebrovascular accidents; and neurological infections. Spinal cord injuries include any injury to the vertebral column, supporting soft tissue, intervertebral discs, or the spinal cord itself. These injuries may be due to lacerations, concussion, tissue compression, or complete severing of the spinal cord. Types of spinal cord injuries include Brown-Séquard syndrome, central cord syndrome, anterior cord syndrome, and posterior cord syndrome. Developmental disorders vary but include conditions that result in impairment in learning, language, behavior, and movement. These conditions may develop at or during conception or shortly after birth. Types of developmental disorders include cerebral palsy, intellectual disability, and prenatal injuries.

Key Terms

accommodation the ability to adjust from near to far vision
anosmia inability to identify odors
aphasia difficulty with all forms of communication
arachnoid middle layer of the meninges between dura and pia mater
autonomic nervous system the division of the nervous system that regulates the involuntary body functions to maintain and restore homeostasis
basal ganglia masses of nuclei located in the deep cerebral hemispheres
bradykinesia slow voluntary movements and speech
brain lateralization communication between the left and right hemispheres
central nervous system (CNS) includes the brain and spinal cord
cephalalgia headache

cerebral cortex a wrinkled outer layer of gray matter
chorea rapid, jerky, involuntary movements
contralateral occurs on opposite side of body
convergence the action of the eyes moving inward to focus with near vision
corpus callosum major communication pathway between the two brain hemispheres
delirium acute, reversible confusion that may be due to an infection, fever, or lack of oxygen
dementia chronic, irreversible confusion
demyelination the destruction of the protective myelin that surrounds nerve fibers in the brain and spinal cord that results in impairment of nerve impulse transmissions
dermatome an area of the skin supplied by a single spinal nerve that sends information to the brain for processing
diencephalon the interbrain, which contains the hypothalamus and thalamus
dura mater outermost layer of the meninges
dysphagia difficulty swallowing
dysphasia difficulty speaking
dysphonia voice impairment
epilepsy a chronic brain disorder characterized by recurrent (two or more) seizures that are not related to a reversible stressor and occur more than 24 hours apart
hypertonia increased muscle tone
hypokinesia diminished movement
hypotonia decreased muscle tone
innervated supplying or being supplied with nerves
ipsilateral occurs on same side of body
mydriasis pupil dilation
myoclonus involuntary muscle jerks
nuchal rigidity stiff, painful neck
nystagmus an involuntary, rhythmic, back-and-forth movement of the eyes
paraplegia lower body paralysis
parasympathetic nervous system the part of the autonomic nervous system that opposes the sympathetic nervous system and regulates automatic bodily functions in times of rest and relaxation
peripheral nervous system (PNS) includes the cranial nerves, spinal nerves, and autonomic nervous system
peripheral neuropathy weakness, numbness, or pain from nerve damage to the peripheral nervous system
photophobia sensitivity to light
pia mater innermost layer of the meninges
postictal state phase that often follows a seizure and can include deep sleep, confusion, headache, and muscle soreness
primary headache occurs independently and is not caused by another medical condition
proprioception the body's ability to sense movement, action, and location of parts of the body
reflex involuntary movement
response actions or changes triggered by sensory stimuli or input
secondary headache symptom of another health disorder that causes pain-sensitive nerve endings to be pressed on or pulled out of place
sensation receiving information about the environment
stereognosis the ability to perceive the physical form and identity of a familiar object, such as a key or paper clip, on the basis of tactile stimuli alone; often referred to as monofilament testing
sympathetic nervous system the part of the autonomic nervous system that responds to perceived stressful or dangerous situations
tetraplegia paralysis of all extremities
transection severing
transient ischemic attack (TIA) stroke symptom that lasts less than 1 hour without evidence of cerebral infarction
trigeminal neuralgia severe facial pain

Assessments

Review Questions

1. What lobe is not part of the cerebral cortex?
   a. frontal
   b. posterior
   c. occipital
   d. temporal

2. The preoperative nurse is performing an assessment of a patient undergoing a shoulder arthroplasty. Because of the positioning used during that surgery, the nurse asks the patient to stick their tongue out in order to get a baseline assessment of which nerves?
   a. VII (facial)
   b. IX (glossopharyngeal)
   c. XI (spinal accessory)
   d. XII (hypoglossal)

3. What is an example of an action not considered a reflex?
   a. blinking
   b. sneezing
   c. running
   d. coughing

4. What is an example of physical effects that are not associated with an impaired nervous system?
   a. loss of balance
   b. dysphagia
   c. depression
   d. headaches

5. For the heel-to-shin test, in which position should the patient be?
   a. semi-fowler's position
   b. standing position
   c. seated position
   d. supine position

6. What is medical term that means difficulty speaking?
   a. dysphagia
   b. dysphasia
   c. dysarthria
   d. aphasia

7. A nurse has just performed a finger-to-nose test on a patient. When does the nurse know the finding is abnormal?
   a. The patient is able to extend their arms back.
   b. The patient can alternate movements.
   c. The patient touches their top lip.
   d. The patient's movements are smooth.

8. The nurse is precepting on a medical-surgical floor. How should the nurse describe Parkinson disease?
   a. being associated with reduced levels of dopamine
   b. being associated with increased levels of dopamine
   c. being associated with reduced levels of serotonin
   d. being associated with increased levels of serotonin

9. What disorder is associated with neuritic plaques and neurofibrillary tangles in the brain?
    a. Huntington disease
    b. Alzheimer disease
    c. Parkinson disease
    d. MS

10. A nurse is caring for a patient on the progressive care unit who has been newly diagnosed with Brown-Séquard syndrome. The patient's wife states she is unsure what the doctor meant by the disorder being ipsilateral. How should the nurse respond?
    a. "Ipsilateral means the symptoms of the syndrome occur on the opposite side of the body."
    b. "Ipsilateral means the symptoms of the syndrome occur on the same side of the body."
    c. "Ipsilateral means the symptoms of the syndrome occur on the upper half of the body."
    d. "Ipsilateral means the symptoms of the syndrome occur on the lower half of the body."

11. A veteran nurse is precepting a new nurse on the pediatric floor. How should the new nurse respond to show she understands cerebral palsy?
    a. "Cerebral palsy is the result of genetics."
    b. "Cerebral palsy only affects motor function."
    c. "Clinical manifestations of cerebral palsy may range from moving impairments, ataxia, paralysis, speech delays, tremors, overactive reflexes, and visual or hearing disturbances."
    d. "Cerebral palsy can be diagnosed after the age of 2 years."

12. A child with FAS may have abnormal facial features, including smoothness to which structure between the upper lip and nose?
    a. bridge
    b. philtrum
    c. nares
    d. zygomatic bone

Check Your Understanding Questions

1. The nurse is caring for a patient who experienced a traumatic brain injury during a motor vehicle accident. The patient's wife asked the nurse why the patient is having trouble breathing if his lungs were not affected by the accident. How should the nurse respond?
2. The nurse is performing a neurological assessment on an 88-year-old patient. What normal age-related changes should the nurse be aware of?
3. The nurse is caring for a 20-year-old college student. The nurse is concerned the patient may have meningitis, based on the patient's presentation and chief complaint. What clinical manifestations are common with this infectious neurological disorder?

Reflection Questions

1. How would you describe how various structures of the body respond in "fight-or-flight" responses?
2. How would the nurse instruct a patient through the testing of their lower body strength?
3. What information might you need to educate a newly pregnant mom on about prenatal injuries?

What Should the Nurse Do?

1. The nurse is assessing a 78-year-old female in the emergency room who had a recent diagnosis of a stroke. The daughter states that she has noticed her mother has had trouble walking, performing personal hygiene, and speaking. How should the nurse respond?
2. The nurse is performing an assessment on a 21-year-old patient and notes an altered mental status. The patient is unable to tell the nurse their name, location, or the date. The patient's speech is garbled. The

patient's family states that this is not normal. What should the nurse do?

3. The nurse is preparing to receive an 83-year-old patient. In report, the nurse was told that the patient has Alzheimer disease and is coming from a nursing home. What should the nurse do to prepare for this admission?

Competency-Based Assessments

1. Describe the cranial nerves.
2. A comprehensive neurological exam has just been performed on a patient. Prepare a sample documentation of a patient with normal findings.
3. What are the risk factors for a stroke and what signs and symptoms may appear?
4. Describe degenerative disorders and list examples.

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CHAPTER 27

Assessment of the Abdomen

FIGURE 27.1 Using comprehensive abdominal assessment along with a detailed medical history can help identify key indicators for underlying health concerns. (credit: modification of "Imaging specialists look beyond the skin" by Senior Airman Lauren Cobin/U.S. Air Force, Public Domain)

CHAPTER OUTLINE

27.1 Structure and Function

27.2 Physical Assessment

27.3 Recognizing Common Abdominal Disorders

INTRODUCTION The abdominal system is a complex body system that has multiple functions for the overall performance of the human body. Each organ plays a specific and vital role. The structure of the organ contributes its function. From birth to older adults, the abdominal system changes as the person ages. When a patient has an acute illness or a chronic medical condition, the abdominal assessment will also change. Knowing and understanding the individual organs and how they function together will aid the nurse in assessing the abdomen.

27.1 Structure and Function

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify structures of the abdomen
- Recognize functions of the abdomen
- Recall effects of impaired function of the abdomen

A thorough assessment of the abdomen provides valuable information regarding the function of a patient's gastrointestinal (GI) and genitourinary (GU) systems. Understanding how to properly assess the abdomen and recognizing both normal and abnormal assessment findings will allow the nurse to provide high-quality care to the

patient. A thorough assessment of the abdominal system will help provide information about the reproductive system, the patient's metabolism, and how the patient's immune system is functioning.

Structures of the Abdomen

The **abdomen** is defined as the anterior region of a person's trunk between the diaphragm and pelvis. The structure of the abdomen can be broken down into external and internal structures.

External Structures

The external structure of the abdomen has dual functions: to assist the body in movement and to protect internal organs (Table 27.1). The layers consist of skin, muscle, fat, and **fascia** (thin, fibrous connective tissue).

Structure	Function
Skin (outermost layer)	Protection, absorption of nutrients, retain moisture
Superficial fascia	Protection; houses nerves and blood vessels
Muscles	Protection, movement, and posture
Transversalis fascia	Protection; houses and anchors structures within the abdomen
Fat	Protection, thermoregulation, insulation
Peritoneum	Protection, insulation, anchors organs in place, secretes lubricating fluids to help reduce friction

TABLE 27.1 Summary of the External Structures of the Abdomen (Source: Wade & Streitz, 2023.)

Abdominal Quadrants

The abdomen is divided into four quadrants to provide a reference to the anatomic location of organs when signs and symptoms arise in the abdomen. This helps guide the provider in clinical decision-making. The two main reference lines intersect at the **naval** (umbilicus) to divide the abdomen into four quadrants (Figure 27.2).

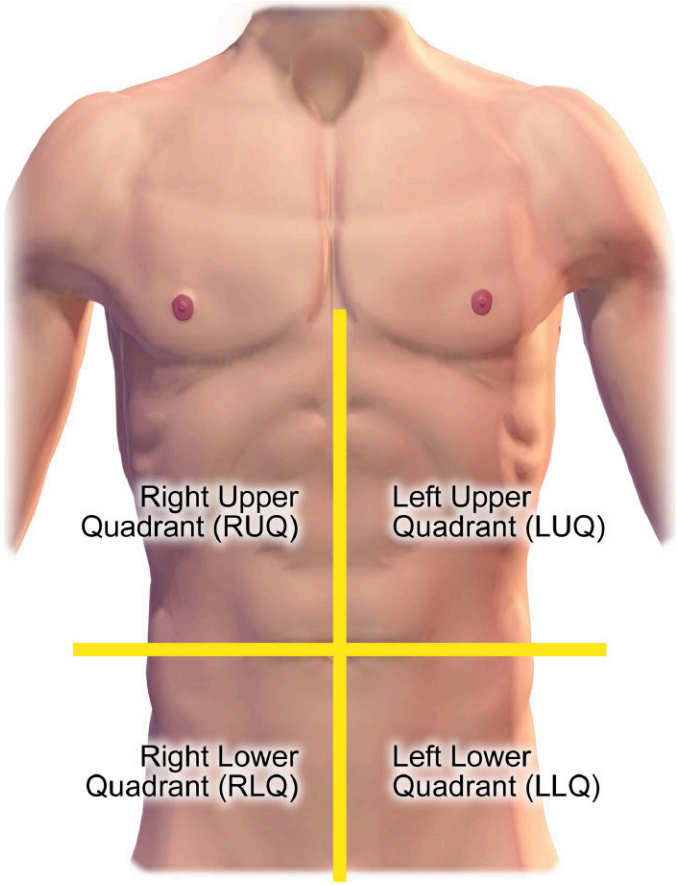

FIGURE 27.2 To visualize the abdomen and its organs, the abdomen is divided into four quadrants for the physical exam. Within those four quadrants, the corresponding abdominal organs are indicated to help guide the physical exam. (credit: modification of “Abdominopelvic Quadrants” by "BruceBlaus"/Wikimedia Commons, CC BY 3.0)

When assessing the abdomen, consider the organs located in the quadrant you are examining:

- **right upper quadrant (RUQ)**: houses the liver, gallbladder, right kidney (posterior abdomen), and a portion of the small intestine and large intestine
- **left upper quadrant (LUQ)**: houses the stomach, the spleen, pancreas, left kidney (posterior abdomen), another portion of the small intestine and large intestine, and a portion of the liver
- **right lower quadrant (RLQ)**: houses the appendix, part of the large intestine (cecum and ascending colon), the right ovary and fallopian tube in females, upper part of the right side of the bladder (the uterus is located below the lower quadrants in the abdominopelvic region)
- **left lower quadrant (LLQ)**: houses the lower part of the large intestine (descending colon), sigmoid colon, and the left ovary and fallopian tube in females, and the upper part of the left side of the bladder

Abdominal Wall Muscles

The abdominal wall muscles work together to provide core stability, posture, movement, and trunk stabilization and support (Figure 27.3). The four main abdominal muscles are the rectus abdominus, external obliques, internal obliques, and transverse abdominus (Table 27.2).

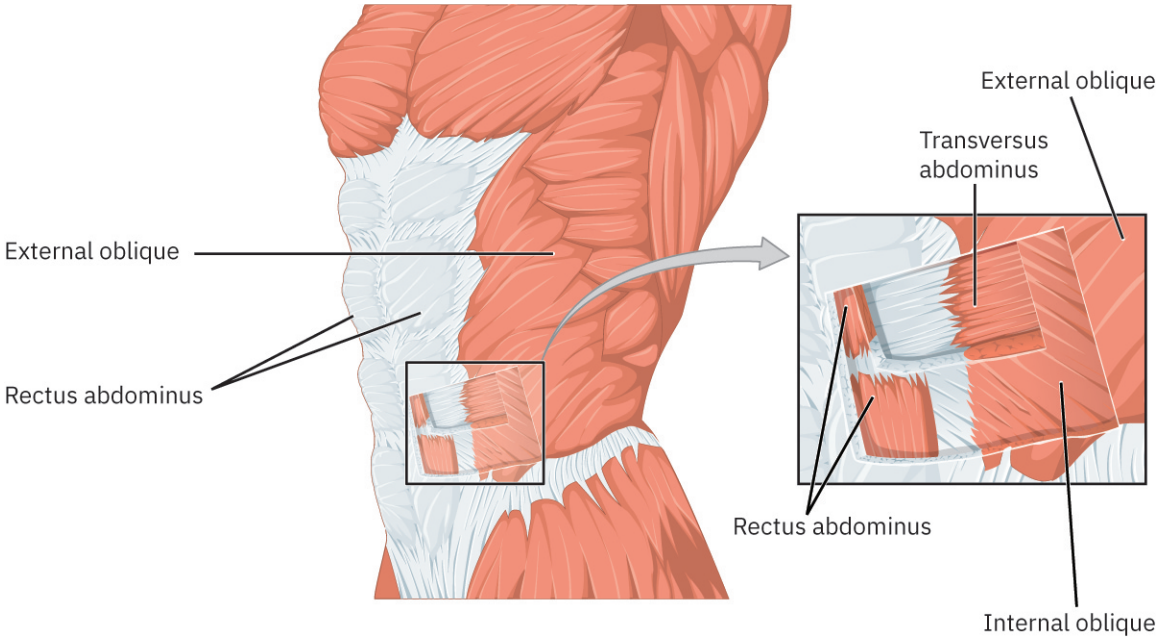

FIGURE 27.3 Each muscle of the abdomen has a specific function for movement. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Muscle	Location and Function
External obliques	• Located on each side of the rectus abdominus; run from the side to the front of the body • Enable trunk rotation from side to side
Internal obliques	• Located under the external obliques; run from the hip bones up to the front of the body • Enable trunk rotation along with the external obliques
Rectus abdominis	• Runs down the middle of the abdomen; often called a "six pack" • Provides stability and posture; holds internal organs in place
Transverse abdominis	• Located under the internal obliques; runs around the spine • Provides trunk stability and maintains internal abdominal pressure

TABLE 27.2 Muscles of the Abdomen (Source: Cleveland Clinic, 2021.)

Internal Structures

Internal structures of the abdomen include vital organs and blood vessels that aid in digestion, metabolism, and overall body function (Figure 27.4). The two main blood vessels in the abdomen are the abdominal aorta and inferior vena cava. The abdominal aorta is the main artery that carries blood away from the heart into the circulatory system. The **inferior vena cava (IVC)** is the body's largest vein; it carries blood to the heart from the bottom half of the body back to the heart.

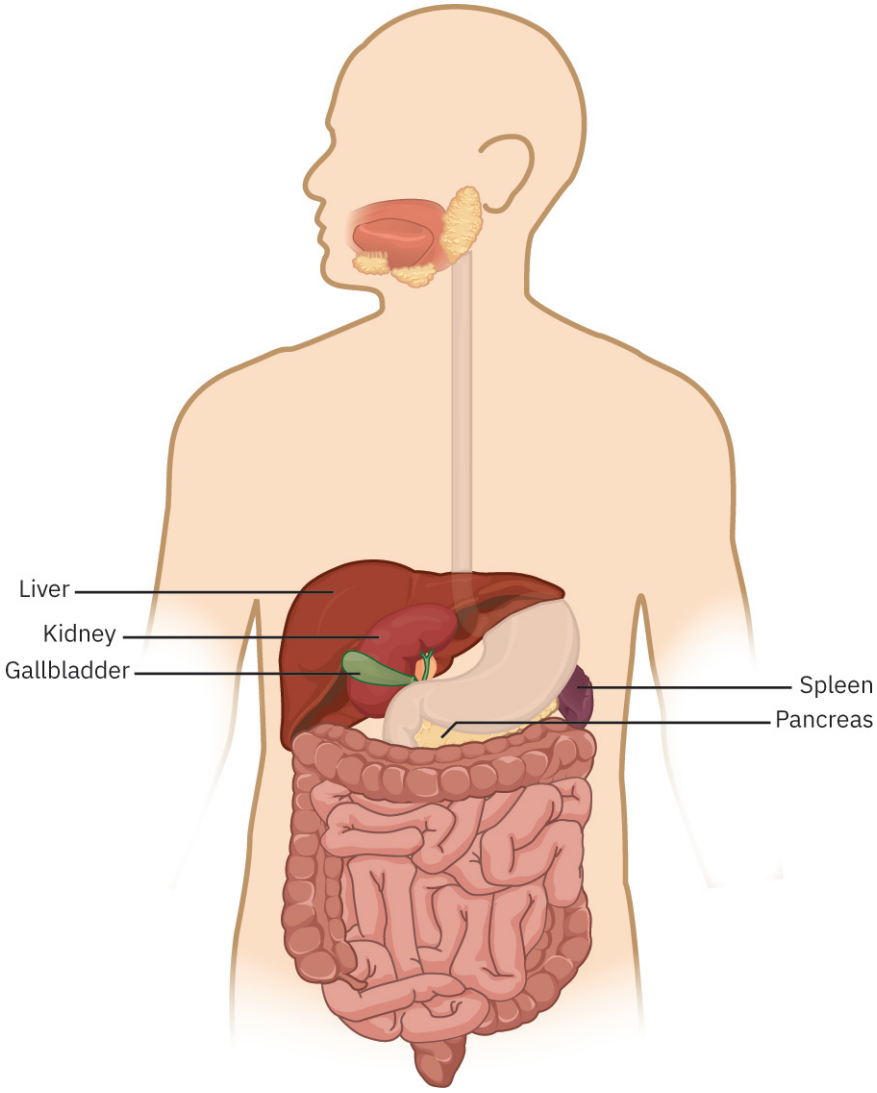

FIGURE 27.4 Internal organs of the abdomen are either solid or hollow, and the structure of each will lead to its overall function. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Each organ in the abdomen has a specialized function, and can be classified as solid or hollow **viscera**. Solid organs are referred to as **solid viscera**. The solid organs of the abdomen include the spleen, kidneys, liver, gallbladder, and pancreas (Table 27.3).

Organ	Function
Gallbladder	• Aids in fluid balance • Filters and removes damaged or old red blood cells from the bloodstream • Produces white blood cells and antibodies to combat infection • Stores bile from the liver and releases to the duodenum to aid in digestion • Stores some blood to aid the circulatory system in the event of hemorrhagic crisis
Kidneys	• Aids in fluid balance • Controls the production of red blood cells • Produce active vitamin D to maintain healthy bones • Releases hormones that regulate blood pressure • Removes waste products and drugs from the body
Liver	• Filters the blood and breaks down toxins • Metabolizes carbohydrates, fats, and proteins • Produces clotting factors to prevent bleeding and albumin to aid in fluid balance • Secretes bile to aid in digestion • Stores, produces, and releases vitamins and minerals into the blood
Pancreas	• Makes digestive enzymes used to digest food in the small intestine • Secretes insulin and glucagon to aid in blood sugar control
Spleen	• Aids in fluid balance • Filters and removes damaged or old red blood cells from the bloodstream • Makes digestive enzymes used to digest food in the small intestine • Produces white blood cells and antibodies to combat infection • Secretes insulin and glucagon to aid in blood sugar control • Stores some blood to aid the circulatory system in the event of hemorrhagic crisis

TABLE 27.3 Solid Organs of the Abdomen (Source: U.S. Department of Health and Human Services, 2017.)

Organs that are hollow tubes or pouches within the abdominal cavity are the **hollow viscera**. When injured, the hollow viscera will spill its contents into the abdominal cavity. The hollow organs of the abdomen include the stomach, small intestine, large intestine, and bladder (Table 27.4).

Organ	Function
Stomach	• Contracts and relaxes to mix and break down food, then push the food to the small intestine • Produces enzymes to digest food • Temporarily stores ingested food
Small intestine	• Absorbs nutrients and extracts water from food • Breaks down food • Moves food along the GI tract to the large intestine

TABLE 27.4 Hollow Organs of the Abdomen (Source: U.S. Department of Health and Human Services, 2017.)

Organ	Function
Large intestine	• Absorbs electrolytes and water from food, turning it into stool • Houses bacteria that further feed on the waste and complete the chemical digestion process
Bladder	• Collects urine from the kidneys and stores urine until it is ready to be expelled from the body

TABLE 27.4 Hollow Organs of the Abdomen (Source: U.S. Department of Health and Human Services, 2017.)

Vascular Structures

In addition to the aorta and the inferior vena cava (IVC), the abdomen contains several other important vascular structures. The three main branches of the aorta supply different organs of the abdomen. These arteries include the:

- celiac trunk: supplies blood to the stomach, spleen, liver, gallbladder and pancreas
- inferior mesenteric artery: supplies blood to the intestines
- superior mesenteric artery: supplies blood to the intestine and pancreas

The branches of the inferior vena cava are referred to as tributaries. Different tributaries drain blood of organs and tissues from those structures back into the IVC. The IVC then carries that blood back to the heart. Important veins of the abdominal cavity that flow into the IVC include:

- gonadal veins: drain reproductive organs of both sexes
- hepatic veins: carry blood away from the liver
- mesenteric veins: carry blood away from the intestines and to the portal veins
- portal vein: carries blood away from the stomach, intestines, and spleen to the liver
- renal veins: carry blood away from the kidneys

LINK TO LEARNING

A breakdown of the venous system of the abdominal cavity (https://openstax.org/r/77venabdcav) is provided in this video. It explains and illustrates how the veins are connected to the inferior vena cava and which organs are supported by each venous tributary.

Functions of the Abdomen

The abdomen functions as a cavity to house vital organs of the digestive, endocrine, urinary, reproductive, and circulatory systems. It also aids in functions such as maintaining intra-abdominal pressure (IAP), forced expiration, bladder emptying, vomiting, excretion, pregnancy, and childbirth.

Protect Abdominal Viscera

The organs within the abdomen are protected by multiple layers of tissue and muscle. When external trauma occurs to the abdomen, the layers of fascia, muscle, and fat collectively work to shield and absorb trauma to the abdomen to protect it.

Increase Intra-Abdominal Pressure

The steady pressure within the abdominal cavity that occurs from the interaction of the abdominal wall and viscera is called **intra-abdominal pressure (IAP)**. Because of the enclosed nature of the abdominal cavity, any deviations in the internal volume caused by things such as organ inflammation, obstruction, ascites (fluid), pregnancy, or a tumor can cause the pressure to increase. The abdominal wall can stretch and evenly distribute the pressure to preserve organ function. In some instances, when the abdominal wall cannot properly compensate for the increase in volume, intra-abdominal pressure can increase and cause organ dysfunction.

Forced Expiration

Forced breathing, also known as **hyperpnea**, is a mode of breathing that can occur during exercise or actions that require the active manipulation of breathing, such as singing. During forced breathing, inspiration and expiration occur due to muscle contractions. In addition to the contraction of the diaphragm and intercostal muscles, other accessory muscles must also contract. During forced inspiration, muscles of the neck, including the scalenes, contract and lift the thoracic wall, increasing lung volume. During forced expiration, accessory muscles of the abdomen, including the obliques, contract, forcing abdominal organs upward against the diaphragm. This helps push the diaphragm further into the thorax, pushing more air out. In addition, accessory muscles (primarily the internal intercostals) help compress the rib cage, which also reduces the volume of the thoracic cavity. During sneezing and coughing, the abdominal muscles contract and the diaphragm relaxes, moving upward into the thoracic cavity, forcing air outside of the lungs.

LINK TO LEARNING

The abdomen and its muscles assist the diaphragm during coughing. What occurs during the cough reflex (https://openstax.org/r/77coughreflex) is illustrated in this video.

Bladder Emptying

When the bladder becomes full, the lower abdomen becomes taut and feels full. During urination, the smooth muscles at the base of the bladder relax to allow urine to flow out. To fully empty the bladder, the bladder contracts to fully expel the urine. Abdominal wall contractions assist with bladder compression and emptying.

Vomiting

Vomiting, also known as **emesis**, is the forceful expulsion of the food contents out of the stomach through the mouth. Vomiting is a protective mechanism to rid the body of harmful substances such as pathogens, irritants, or spoiled food. The abdominal wall muscles assist with vomiting by contracting and increasing intra-abdominal pressure (IAP), encouraging the stomach to contract and force the food up the esophagus and out of the mouth.

Excretion

Part of the digestive system's job is removing waste from the body, which may be stool or excess gas. When a person passes excess intestinal gas through the rectum, this is called **flatulence**. Excess gas may be a byproduct from bacterial breakdown of food; foods that produce gas as a natural byproduct, such as complex carbohydrates; or carbonated beverages.

Flatulence is a normal bodily function that results in malodorous gas. The final step of the digestive system's job is removing waste in the act of **defecation**. Defecation is the process of eliminating waste from the body through the rectum and anus. Indigestible food, also known as feces, accumulates in the last part of the large intestine (rectum). When the rectum fills, the smooth muscle stretches, signaling to the brain it is time to empty the rectum. When it is time to defecate, the smooth muscle of the anal sphincter relaxes and the rectum contracts, expelling the feces from the body. Abdominal muscles aid in **peristalsis** (the wavelike movements of the intestines to move contents forward) by contracting to increase intra-abdominal pressure during defecation. For a comprehensive abdominal assessment, the nurse should ask the patient questions related to defecation; for example: What was the consistency of the stool? Was there blood in the stool? Was this the first bowel movement in the past 24 hours?

LIFE-STAGE CONTEXT

Constipation in Older Adults

Chronic constipation increases with age, especially after age 60 years. Risk factors for constipation in older adults include weakness of the abdominal and pelvic floor muscles, immobility, malnutrition, chronic medical conditions, aging effects on colonic motility, and chronic medication use. Chronic constipation can cause complications such as hemorrhoids, rectal bleeding, fecal impaction, anal pain, anal fissures, and rectal ulcers. Dietary and lifestyle modifications are the primary interventions in the treatment and prevention of chronic constipation (Mari et al.,

2020).

Pregnancy and Childbirth

During pregnancy, the abdominal wall muscles and ligaments stretch to accommodate the growing baby and uterus, keep internal organs in place, and maintain a healthy intra-abdominal pressure. The rectus abdominus muscles are held together by a ligament band called the linea alba, which softens and stretches, separating the two rectus muscles away from each other (National Health Service, 2024). This is called recti divarication (Figure 27.5). This divarication usually resolves in the first few months after delivery.

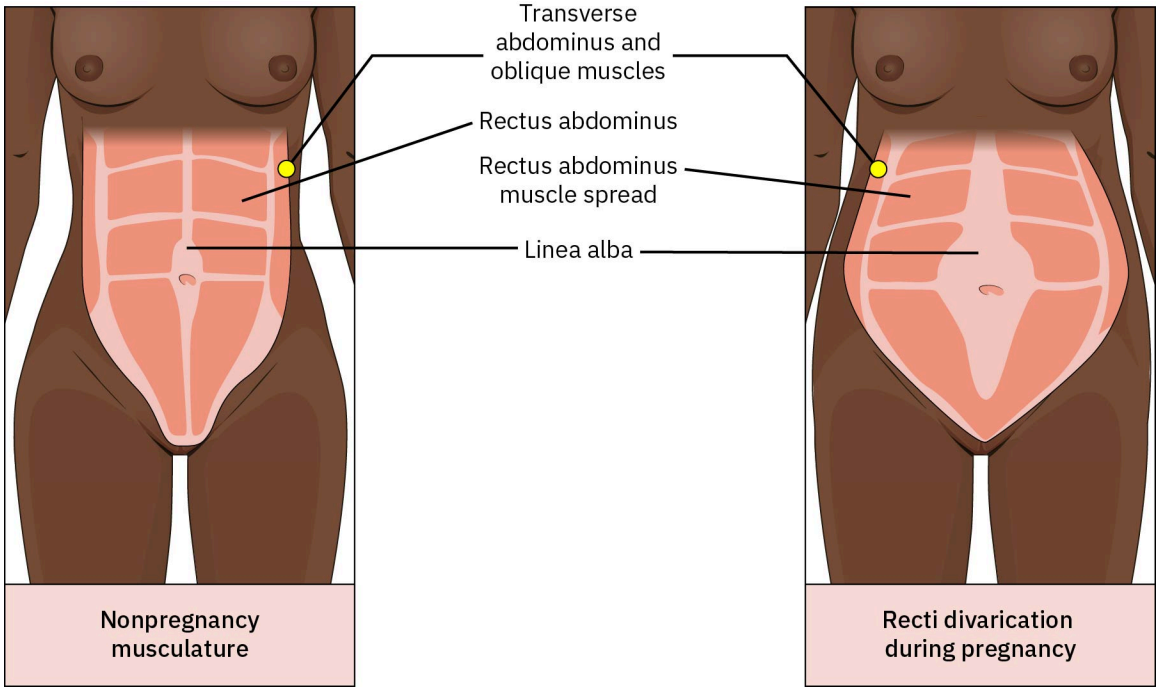

FIGURE 27.5 The rectus abdominis muscles spread apart during pregnancy to maintain a healthy intra-abdominal pressure during pregnancy. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Effects of Impaired Function of the Abdomen

Dysfunction of one or more intra-abdominal organs will manifest in different ways. The patient may feel pain, experience **bloating** (feeling of fullness), have a change in bowel habits, or have abdominal distention. Many different things can cause the abdominal organs to not function correctly. Some common causes of impaired function include:

- Medications: Some medications have known side effects that cause stomach discomfort. Opioids cause constipation. Antibiotics may cause diarrhea. Overuse of antacids and nonsteroidal anti-inflammatory drugs change the amount of acid the stomach produces, which leads to stomach discomfort, reflux, bloating, or diarrhea.
- Poor diet and lack of exercise: A diet low in fiber and lack of exercise can cause constipation, which leads to abdominal distention and bloating. Conversely, a high-fiber diet, or sometimes greasy foods, can cause the patient to experience **diarrhea** (frequent, loose, watery stool).
- Reflux: Gastroesophageal reflux (GERD) may occur when there is too much acid in the stomach, or the muscle from the esophagus to the stomach is weak. When this occurs, the patient may experience “heartburn,” which is acid that moves out of the stomach back into the esophagus. Patients may experience pain, bloating, or frequent belching.
- Stress: Poorly managed stress in a patient’s life may manifest as stomach pain and discomfort.

LIFE-STAGE CONTEXT

Normal Age-Related Changes in the Abdomen

As people age, the abdomen goes through various changes, such as in muscle tone, metabolism, digestive, and ligament or tissue changes (Table 27.5). It is important to encourage older adults to continue to maintain an active lifestyle as well as follow a diet full of fresh fruits, vegetables, and fiber.

Change	Effect on the Body
Digestion changes	Slower gut motility, decreased production of digestive enzymes, slower metabolism, changes in bowel habits
Hormone changes	Especially in older women when there is less estrogen in the body, which causes fat distribution to the body (Ruiz, 2019)
Increased fat accumulation	Older adults accumulate more fat, and this can increase the waist circumference, causing abdominal obesity. This can result from visceral fat accumulation as well.
Muscle tone	Decline in muscle tone, causing the muscles to become weaker and provide less support to the abdominal cavity
Weakening of the abdominal ligaments	The ligaments that support the abdominal organs weaken and may be displaced downward; this can cause hernias or prolapse of pelvic organs.

TABLE 27.5 Normal Age-Related Changes of the Abdomen

Pain

Abdominal pain is experienced by everyone at some point. Frequent ways people describe abdominal pain include:

- colicky or wavelike: starts and ends suddenly
- cramp-like: most commonly caused by GI disturbances
- generalized: pain felt over more than half of the abdomen
- localized: pain is felt in only one area of the abdomen

Abdominal pain can be caused independently and simultaneously by many different things because multiple organs and structures are contained within the abdomen. Examples include food poisoning, constipation, stress, food allergies, cancer, menstrual cramps, endometriosis, ulcers, appendicitis, pancreatitis, kidney stones, and muscle strain.

Bloating

Bloating is the feeling of fullness and tightness in the abdomen. It is often accompanied by discomfort or a stomach distention. Common causes of bloating include excess gas in the digestive system, overeating, and constipation. Bloating may be temporary or chronic.

Nausea

The sensation of discomfort and unease in the stomach that is often accompanied by the urge to vomit is **nausea**. It is triggered by multiple stimuli from the nervous system that is meant to be protective. Nausea may or may not be accompanied by vomiting. Common causes of nausea include motion sickness, pregnancy, food poisoning, infection, medications, or other medical conditions.

Loss of Appetite

Loss of appetite is referred to as **anorexia**. It may be caused by various factors, such as illness, stress, emotional factors, medications, or digestive issues. It is often a symptom of an underlying health issue. Prolonged loss of appetite may lead to unintended weight loss and malnutrition.

Diarrhea or Constipation

Diarrhea is a common digestive problem characterized by frequent, loose, watery stool. Diarrhea may be acute and temporary or due to a chronic condition. It can be caused by infection (bacterial, parasitic, or viral), food poisoning, diet, medications, or GI conditions such as irritable bowel syndrome, Crohn's disease, and celiac disease. The intestines fail to absorb water and nutrients, which can lead to dehydration due to water loss. Often, a stool sample is needed to determine exact cause or rule out bacterial infections.

The term **constipation** refers to a condition characterized by uncomfortable, infrequent bowel movements. The stool is often dry, hard, and painful to pass. It may be caused by a lack of dietary fiber, poor water intake, sedentary lifestyle, medications, or other chronic medical conditions.

PATIENT CONVERSATIONS

Collecting a Stool Sample from an Embarrassed Patient

Scenario: Nurse walks into the emergency room bay to assess a patient being admitted for chronic diarrhea. The provider has also ordered a stool sample to be collected. The patient seems anxious and guarded, answering questions with one-word answers.

Nurse: Hi, my name is Collette and I'm going to be your nurse today. Would you mind verifying your name and date of birth for me?

Patient: Okay... Lisa Washington, 5/22/92.

Nurse: Nice to meet you, Lisa. I understand you're here for diarrhea and abdominal pain. I'm going to do an assessment, then I'd like to get a stool sample from you. I have a kit here and I'll show you how to collect it the next time you go to the bathroom.

Patient: Is that necessary? That sounds really gross, and I really don't want you to have to touch that.

Nurse: Oh no! I wouldn't have to touch anything. In this collection kit, you have a plastic collection device to place on the toilet to collect your stool. You then scoop some up with this little spatula, put it in this cup, then screw the lid on. I won't have to touch anything but the container.

Patient: I guess that's okay, then. But can you make sure no one sees you leave the room with it in your hand? I don't want anyone to know that it's mine.

Nurse: Not a problem, Lisa. I'll put the container in a collection bag that you can't see through. No one will know what's in the bag. So, are you ready for your assessment, now?

Patient: Sure. Thanks so much, Collette.

27.2 Physical Assessment

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Analyze how to perform a comprehensive abdominal assessment
- Describe abnormalities identified during the assessment of the abdomen
- Recall proper documentation of the abdominal assessment

A thorough assessment of the abdomen provides valuable information regarding the function of a patient's GI and GU systems. Understanding how to properly assess the abdomen and recognizing both normal and abnormal assessment findings will allow the nurse to provide high-quality care to the patient.

This unit discusses how to complete a comprehensive abdominal assessment using subjective and objective data. Abnormalities are discussed, as well as how to properly validate and document findings.

Comprehensive Abdominal Assessment

The GI system is responsible for the ingestion of food and the absorption of nutrients. Additionally, the GI and GU

systems are responsible for the elimination of waste products. Therefore, during assessment of these systems, the nurse collects subjective and objective data regarding the underlying structures of the abdomen, as well as the normal functioning of the GI and GU systems.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Performing an Abdominal Assessment

See the competency checklist for Performing an Abdominal Assessment. You can find the checklists on the Student resources tab of your book page on openstax.org.

Subjective Data

During focused GI and GU subjective assessments, the nurse collects data about the signs and symptoms of GI and GU diseases, including any digestive or nutritional issues, relevant medical or family history of GI and GU diseases, and any current treatment for related issues (Table 27.6). Information gained from the interview process is used to tailor the subsequent physical assessment and create a plan for patient care and education.

Interview Questions	Follow-Up
Have you ever been diagnosed with a gastrointestinal, kidney, pancreas, liver, gallbladder, or bladder condition?	Please describe the conditions and treatments.
Have you ever had abdominal surgery?	Please describe the surgery and if you experienced any complications.
Are you currently taking any medications, herbs, or supplements?	Please describe.
Do you have any abdominal pain?	Are there any associated symptoms with the pain such as fever, nausea, vomiting, or change in bowel pattern? Are you having bloody stools (**hematochezia**); dark, tarry stools (**melena**); abdominal distention; or vomiting of blood (**hematemesis**)? When did the pain start to occur? (Onset) Where is the pain? (Location) When it occurs, how long does the pain last? (Duration) Can you describe what the pain feels like? (Characteristics) What brings on the pain? (Aggravating factors) What relieves the pain? (Alleviating factors) Does the pain radiate anywhere? (Radiation) What have you used to treat the pain? (Treatment) What effect has the pain had on you? (Effects) How severe is the pain, on a scale from 0 to 10, with 10 being the worst, when it occurs? (Severity) Where is the pain located? What makes the pain better? Have you had this pain before?
Have you had any issues with nausea, vomiting, food intolerance, heartburn, ulcers, change in appetite, or weight?	Please describe. What treatment did you use for these symptoms? What is your typical diet in a 24-hour period?

TABLE 27.6 Interview Questions for Subjective Assessment of GI and GU Systems

Interview Questions	Follow-Up
Do you have any difficulty swallowing food or liquids (dysphagia)?	Please describe. Have you ever been diagnosed with a stroke or transient ischemic attack?
When was your last bowel movement?	Have there been any changes in pattern or consistency of your stool? Are you passing any gas?
Have you had any issues with constipation or diarrhea?	Please describe. How long have you had these issues? What treatment did you use for these symptoms? If constipation: • Has constipation been a problem for you throughout your life? • How frequently do you usually have a bowel movement? If diarrhea: • Are your stools watery or is there some form to them? • How many episodes of diarrhea have you had in the past 24 hours?
Do you experience any pain or discomfort with urination (**dysuria**)?	Please describe. If you have discomfort while urinating, is the discomfort internal or external? Do you use any treatment for these symptoms?
Do you experience frequent urination (urinary frequency)?	Please describe. Does the frequency occur during daytime or nighttime hours?
Do you ever experience a strong urge to urinate that makes it difficult to reach the bathroom in time (urinary urgency)?	Does this strong urge ever result in a leakage of urine? Does the urge come and go or is it continuous?
Do you have any involuntary leakage of urine when you cough, sneeze, or jump (urinary incontinence)? Do you have difficulty starting the flow of urine?	Have you tried any treatment for this issue?

TABLE 27.6 Interview Questions for Subjective Assessment of GI and GU Systems

Abdominal pain should be explored just like any pain in any other body system. When discussing pain with the patient, follow questions in the sequence PQRST for the assessment, as follows:

- Provocation: What started the pain?
- Quality: What does the pain feel like?
- Region (or radiation): make sure you note the location using the quadrants
- Severity or scale: use the numerical pain scale 0–10 or use a pain scale to match the patient's developmental stage or situation
- Timing: Is the pain worse at certain times of the day, after eating, better with stooling?

The location and the pain elicited will guide the diagnostics steps. For example, pain upon palpation of the LRQ often is associated with referred pain from appendicitis. More examples of pain related to the quadrant system are as follows: pain felt in the RUQ may be from cholecystitis (inflammation of the gallbladder), pain in the LUQ could indicate gastritis (stomach inflammation), pain in the LLQ could indicate colitis (inflammation of the colon). Diagnostic studies to rule out appendicitis like an ultrasound or computed tomography (CT) scan may be ordered.

Objective Data

Physical examination of the abdomen includes inspection, auscultation, palpation, and percussion. Note that the order of physical assessment differs for the abdominal system compared to other systems. Palpation should occur after the auscultation of bowel sounds so that accurate, undisturbed bowel sounds can be assessed. The abdomen is roughly divided into four quadrants: right upper, right lower, left upper, and left lower (Figure 27.6). When assessing the abdomen, consider the organs located in the quadrant you are examining.

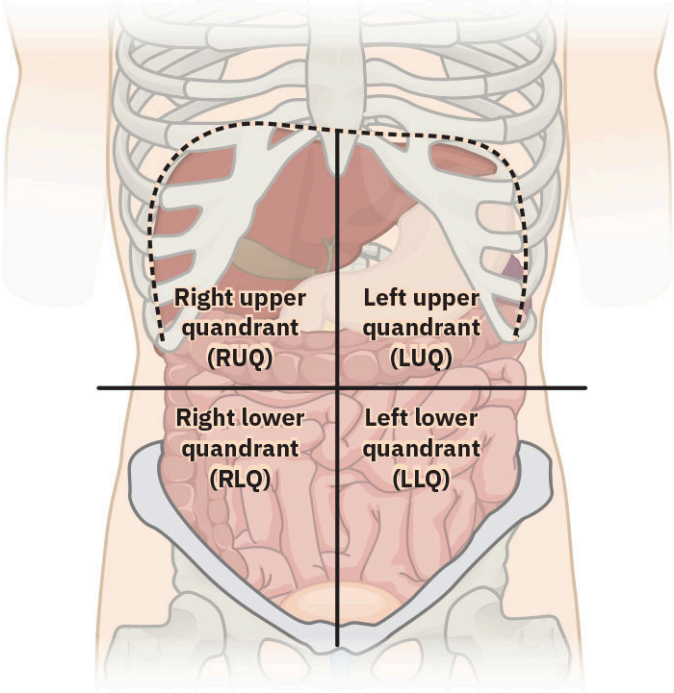

FIGURE 27.6 It is helpful to correlate the anatomic location of the organs within the abdomen in quadrants when completing an abdominal assessment. (credit: modification of work from *Anatomy and Physiology 2e*. attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

In preparation for the physical assessment, the nurse should create an environment in which the patient will be comfortable. Encourage the patient to empty their bladder prior to the assessment. Warm the room and stethoscope (by rubbing with hands) to decrease the likelihood of the patient tensing during the assessment.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Preparing for the Abdominal Exam

1. Perform hand hygiene and properly don personal protective equipment, if needed.
2. Introduce yourself to the patient.
3. Verify the patient's information using name and date of birth.
4. Explain to the patient the steps of the abdominal exam and obtain consent.
5. Position the patient supine. If needed, a small pillow to support the head and underneath the knees may be used.
6. Expose the patient from nipple to lower abdomen, maintaining modesty by using a blanket or gown.
7. Begin the assessment by systematically using the process of "look, listen, and feel."

Inspection

The abdomen is inspected by positioning the patient supine on an examining table or bed. The head and knees should be supported with small pillows or folded sheets for comfort and to relax the abdominal wall musculature. The patient's arms should be at their side and not folded behind the head, because doing so tenses the abdominal wall. Ensure the patient is covered adequately to maintain privacy while still exposing the abdomen as needed for a thorough assessment. Visually examine the abdomen for overall shape, masses, skin abnormalities, and any abnormal movements.

- Observe the general contour and symmetry of the entire abdominal wall. The contour of the abdomen is often described as flat, rounded, **scaphoid** (sunken), or **protuberant** (convex or bulging).
- Assess for distention. Generalized distention of the abdomen can be caused by obesity, bowel distention from gas or liquid, or fluid buildup.
- Assess for masses or bulges, which may indicate structural deformities like **hernia**s (abdominal bulges) or be related to disorders in abdominal organs.
- Assess the patient's skin for uniformity of color, integrity, scarring, or **striae**. Striae are white or silvery elongated marks that occur when the skin stretches, especially during pregnancy or excessive weight gain.
- Note the shape of the umbilicus; it should be inverted and midline.
- Carefully note any scars and correlate these scars with the patient's recollection of previous surgeries or injury.
- Document any abnormal movement or pulsations. Visible intestinal peristalsis can be caused by intestinal obstruction. Pulsations may be seen in the epigastric area of patients who are especially thin, but otherwise should not be observed.

Auscultation

Listening with a stethoscope to the abdomen, or auscultation, is done after inspection for more accurate assessment of bowel sounds. Use a warmed stethoscope to assess the frequency and characteristics of the patient's bowel sounds, which are also referred to as peristaltic murmurs.

Begin your assessment by gently placing the diaphragm of your stethoscope on the skin of the RLQ, because bowel sounds are consistently heard in that area. Bowel sounds are generally high-pitched, gurgling sounds that are heard irregularly. If you do not hear any bowel sounds, continue to listen for 5 minutes within that quadrant before moving on to the next quadrant. Move your stethoscope to the next quadrant (RUQ) in a clockwise motion around the abdominal wall. Listen for 1 full minute per quadrant. Normally, bowel sounds are heard in all four quadrants.

It is not recommended to count abdominal sounds, because the activity of normal bowel sounds may cycle with peak-to-peak periods as long as 50 to 60 minutes. Instead, bowel sounds should be described as normal, hyperactive, or hypoactive. The majority of peristaltic murmurs are produced by the stomach, with the remainder from the large intestine and a small contribution from the small intestine. Because the conduction of peristaltic murmur is heard throughout all parts of the abdomen, the source of peristaltic murmur is not always at the site where it is heard. If the conduction of peristaltic sounds is good, auscultation at a single location is considered adequate.

Auscultation revealing **hyperactive bowel sounds** may indicate bowel obstruction or gastroenteritis. Sometimes you may be able to hear a patient's bowel sounds without a stethoscope; this often is described as "stomach growling" or **borborygmus**. This is a common example of hyperactive sounds. With constipation, after abdominal surgery, peritonitis, or paralytic ileus, there may be **hypoactive bowel sounds**. As you auscultate the abdomen, you should not hear vascular sounds. If heard, this finding should be reported to the healthcare provider because it could indicate aortic aneurism or renal artery stenosis (Mealie et al., 2022).

LINK TO LEARNING

This video on palpating the abdomen (https://openstax.org/r/77palabdomen) reviews this important step of the abdominal assessment. Review how to properly perform both light and deep palpation.

Palpation and Percussion

The term palpation refers to touching of the abdomen using the flat of the hand and fingers (not the fingertips) to detect palpable organs, abnormal masses, or tenderness (Figure 27.7). When palpating the abdomen of a patient reporting abdominal pain, the nurse should palpate the painful area last. Light palpation is primarily used by bedside nurses to assess for musculature, abnormal masses, and tenderness. Deep palpation is a technique used by advanced practice clinicians to assess for enlarged organs.

Encourage the patient to empty their bladder prior to palpation. When palpating the abdomen, ask the patient to bend their knees when lying in a supine position to enhance relaxation of abdominal muscles. Lightly palpate the abdomen by pressing into the skin about 0.5 in. (~1 cm) beginning in the RLQ. Continue to move around the abdomen in a clockwise direction.

FIGURE 27.7 The correct way to palpate an abdomen is by using the flat part of the fingers. (credit: "DSC 2286 -1024x678 .jpg" by British Columbia Institute of Technology, CC BY 4.0)

Palpate the bladder for distention. Palpate gently from umbilicus down toward the pelvis feeling for a full bladder. The bladder is not normally palpable, but a distended bladder may reach the umbilicus. A full bladder presents as a pelvis mass that is typically regular, smooth, firm, and oval shaped. It arises in the midline. Note the patient's response to palpation, such as pain, guarding, rigidity, or rebound tenderness. The term **voluntary guarding** refers to voluntary contraction of the abdominal wall musculature, usually due to fear, anxiety, or the touch of cold hands. Involuntary guarding is the reflexive contraction of overlying abdominal muscles as the result of peritoneal inflammation. Involuntary contraction of the abdominal musculature in response to peritoneal inflammation is called **rigidity**, a reflex the patient cannot control. And **rebound tenderness** is another sign of peritoneal inflammation or peritonitis. To elicit rebound tenderness, the clinician maintains pressure over an area of tenderness and then withdraws the hand abruptly. If the patient winces with pain upon withdrawal of the hand, the test is positive.

You may observe advanced practice nurses and other healthcare providers percussing the abdomen to obtain additional data. Percussing can be used to assess the liver and spleen or to determine if costovertebral angle tenderness is present, which is related to inflammation of the kidney.

Abnormalities of the Abdominal Assessment

While assessing the abdomen, it is important not only to recognize normal findings but to recognize abnormalities as well (Table 27.7).

Finding	Possible Indications
Caput medusae (distended veins that extend from the umbilicus)	Liver cirrhosis, portal hypertension
Cullen sign (**ecchymosis**, or bruising, in the subcutaneous fatty tissue below the umbilicus) (credit: "Cullen's sign" by Herbert L. Fred/Wikimedia Commons, CC BY 2.0)	Hemorrhagic pancreatitis
Distention (credit: "F1: Preoperative appearance of the patient showing abdominal distention" by World Journal of Surgical Oncology/National Library of Medicine, CC BY 2.0)	Constipation, obesity, irritable bowel syndrome, ascites, ovarian cancer, hepatosplenomegaly, intestinal obstruction, ascites, intestinal gas, ulcerative colitis gallstones, food intolerance, pregnancy

TABLE 27.7 Abnormal Findings During Abdominal Assessment

Finding	Possible Indications
Grey Turner sign (ecchymosis along the flank) (credit: modification of "Hemorrhagic pancreatitis – Grey Turner's sign" by Herbert L. Fred/ Wikimedia Commons, CC BY 2.0)	Intra-abdominal hemorrhage associated with acute necrotizing pancreatitis
Soft abdominal protrusion (credit: "Umbilical hernia 01" by "Saltanat"/Wikimedia Commons, Public Domain)	Hernia (an abdominal organ, usually the intestine, pushes through the muscle of the abdominal wall)

TABLE 27.7 Abnormal Findings During Abdominal Assessment

REAL RN STORIES

Abdominal Pain

Nurse: Sarah, RN
Clinical setting: Emergency department
Years in practice: 8
Facility location: Fort Worth, Texas

I was working in the pediatric emergency department and an 18-year-old patient came in with his mom with a chief complaint of intermittent abdominal pain and diarrhea for the past 2 days. The patient had gone to his primary care doctor the day before for evaluation. Mom reported that the provider evaluated the young man and diagnosed him with a stomach virus. Mom said that at the time of the visit with the doctor, her son was eating and drinking and seemed like he was back to normal. Overnight, the young man woke up with unbearable abdominal pain that caused him to double over and new onset vomiting, which brought him to the emergency department. When I triaged him, it was evident that his pain level was high, and initial assessment showed abdominal distension, hypoactive bowel sounds, and pain on palpation. He also had a fever of 102.4°F (39°C) and was extremely anxious. I alerted the provider immediately to assess the patient. The patient was quickly assessed and sent for imaging, which revealed he had peritonitis caused by intussusception (when the intestine folds into itself). He was sent emergently for surgery. Honestly, I thought it was an appendicitis because that's what you learn about. Looking back at this history,

I realized that his feeling fine on and off but then crying out in pain was from the telescoping of the intestine.

Ascites

Ascites is characterized by abnormal accumulation of fluid in the abdominal cavity. Fluid buildup can be the result of liver disease, heart failure, kidney disease, or cancer. When fluid accumulates in the abdominal cavity, the abdomen will appear swollen and distended (Figure 27.8). The patient often feels discomfort and may have a difficult time breathing. A technique to determine ascites is to check for a **fluid wave**. Have the patient lie flat with their hands down on the midline of the abdomen. Tap on one side of the flank while holding your palm flat on the other side of the flank. If the tap is felt by the other hand, that means there is free fluid or ascites in the abdominal cavity. If the tap is not felt, the distention may be caused by be caused by other conditions, such as dilated loops of bowel or fat.

FIGURE 27.8 A patient with ascites. The presence of fluid in the peritoneal cavity causes the abdomen to be distended. A tube is placed to drain the fluid. (credit: "Draining ascites, secondary to hepatic cirrhosis" by John Campbell/Flickr, Public Domain)

LINK TO LEARNING

See how a fluid wave test (https://openstax.org/r/77fluidwavtes) is performed.

Impaired Elimination

Common alterations in bowel elimination include constipation, diarrhea, and bowel incontinence. These alterations are common signs and symptoms in several diseases and conditions of the GI system. Urinary tract infection, urinary incontinence, and urinary retention are common alterations in urinary elimination. See Table 27.8 for a comparison of expected versus unexpected findings when assessing the abdomen.

Assessment	Expected Findings	Unexpected Findings (document and notify the provider of any new findings*)
Inspection	Flat or rounded contour (protuberant in children until age 4 years) Intact skin No visible lesions Symmetry of shape and color	Asymmetry Distension Pulsations Scars Skin breakdown Visible peristalsis Wounds
Auscultation	Presence of normal bowel sounds	Absent bowel sounds Hyperactive bowel sounds Hypoactive bowel sounds
Palpation	Absence of masses Absence of pain or tenderness Voluntary guarding	Involuntary guarding Masses noted that are not previously documented Pain on palpation Rebound tenderness Rigidity
Genitourinary	Absence of pain, urgency, frequency, or retention Clear, pale-yellow urine Nondistended bladder	Dark or bloody urine, foul odor, or sediment present Dysuria Urinary frequency Urinary retention, indicated by distended bladder and/or tenderness on palpation Urinary urgency
*CRITICAL CONDITIONS to report immediately		Bloody stools Hematemesis New or worsening melena Signs of dehydration associated with diarrhea and vomiting, such as <30 mL/h urine

TABLE 27.8 Expected Versus Unexpected Gastrointestinal and Genitourinary Assessment Findings

Validating and Documenting Findings

After completing the abdominal exam, it is important to validate that objective data found on physical exam is in line with the subjective data gathered during patient interview. If there are discrepancies or inconsistences in the findings, it may be necessary to repeat parts of the exam or clarify questions in the patient interview before formulating the diagnosis. This is crucial because if there are gaps or irregularities and a diagnosis is made on the basis of those incorrect findings, the treatment plan may not address the patient's chief complaint. For example, if a patient reports profuse vomiting during the patient interview, the patient exam should also reflect that. The patient exam should reflect this to validate the data.

Documentation should be described using the quadrants as a reference. For example, "Rebound tenderness felt with light palpation in the right lower quadrant (RLQ)." Documentation should include results of the following:

- **auscultation**: description of bowel sounds (normal bowel sounds, hyperactive, hypoactive or absent), bruits
- **inspection**: shape and contour, skin coloring, visible veins, evidence of bruising, any medical devices such as ostomy bags or gastronomy tubes

- **palpation**: Both light and deep palpation findings should be documented. Note any masses felt and location on the abdomen. Tenderness and rebound tenderness should also be documented.
- **percussion**: Sounds heard over each quadrant with percussion may include tympanic sounds over air- and fluid-filled spaces, or dullness over solid organs.

27.3 Recognizing Common Abdominal Disorders

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Examine the common causes for abdominal distention
- Recognize the common causes for abdominal bulges
- Remember the cause of enlarged abdominal organs

Patients may experience a multitude of symptoms when experiencing an abdominal disorder. Symptoms include increased gassiness, diarrhea, constipation, or pain. Abdominal disorders can be distinguished by general fullness or swelling called distention and or localized swelling referred to as bulges. Using a detailed patient interview to guide the physical exam, a nurse not only will be able to perform a complete abdominal assessment but also help identify causes of common abdominal disorders from distention to abdominal hernias and enlarged organs.

Common Causes of Abdominal Distention

It is important to assess for abdominal distention because it is a manifestation of numerous diseases. Assessing the abdomen when the patient is in the supine position is needed to see the abdomen in a relaxed state and the contour of the abdomen. Remembering to assess the abdomen in a look, listen, feel order. If the patient is sitting up during an abdominal exam, it is difficult to see if the abdomen is flat, concave, rounded, or distended. This positioning allows the nurse to assess for distention or bulges. The most common causes of abdominal distention are the “5 Fs” (Cleveland Clinic, 2021):

- Fat: Excess amounts of fat may be in the abdominal area due to obesity or a manifestation of certain diseases, such as Cushing syndrome. Excess visceral (abdominal) fat is associated with an increased risk for cardiovascular disease and insulin resistance.
- Flatus: Increased gas in the intestines can be caused by numerous conditions, such as **aerophagia** (swallowing air), food intolerance, carbonated beverages, irritable bowel syndrome, constipation, ulcerative colitis, and certain medications.
- Feces: Constipation can cause a buildup of feces in the intestines, in turn causing abdominal distention.
- Fluid: Ascites is a buildup of fluid in the **peritoneal space** (the layer of tissue that surrounds the abdomen) resulting from congestion within the liver, creating distention.
- Fetus: Abdominal distention during pregnancy occurs due to the growing uterus, which is housed in the lower abdomen. Different hormones during pregnancy allow the abdominal muscles to relax to allow for this expansion.

LIFE-STAGE CONTEXT

Age-Related Changes with Bowel Elimination: Age Is Not Just a Number

Getting older is a normal and healthy part of life. As one grows older, one of the benefits is that one may get wiser and develop life skills. Likewise, one must also make adjustments in their life to accommodate the changes related to the GI tract. When an individual ages, the following occur:

- Changes in diet and physical activity: As a person ages, they may become less active and lead a sedentary lifestyle, which contributes to constipation. Furthermore, an older person may need more fiber in the diet to account for the slowing of the intestines.
- Decreased muscle tone: Muscles lose tone over time and may cause stool to move more slowly through the intestines.
- Medications: As a person ages, they may need to take multiple medications. Often, a side effect of these medications is impaired bowel function leading to constipation.

- Slower digestion: When a person ages, the gut motility (how food moves through the gut) slows down. This can result in constipation.
- To account for these changes, the older adult should maintain a balanced diet full of fiber, stay well hydrated, engage in regular physical activity, and communicate with their provider about changes in their bowel patterns.

Common Causes of Abdominal Bulges

Common causes of abdominal bulges are hernias. Abdominal bulging may be differentiated from abdominal distention such that abdominal bulging may be localized to a specific area of the abdomen and not the entire abdomen. Abdominal bulges may be from hernias, tumors or masses, or enlargement of organs.

Hernias

Hernias are a common cause of abdominal bulges. A hernia occurs when an abdominal organ pushes through a weakness in the abdominal wall. There are different types of hernias; they are named for their location on the body (Figure 27.9), and include:

- epigastric hernia, involves the upper part of the stomach
- femoral hernia, similar to the inguinal hernia but lower in the groin; most commonly found in females
- incisional hernia, results from a surgical incision (healed or not fully healed)
- inguinal hernia (direct or indirect), the most common type of hernia that occurs in the groin or scrotum
- umbilical hernia, found at the belly button

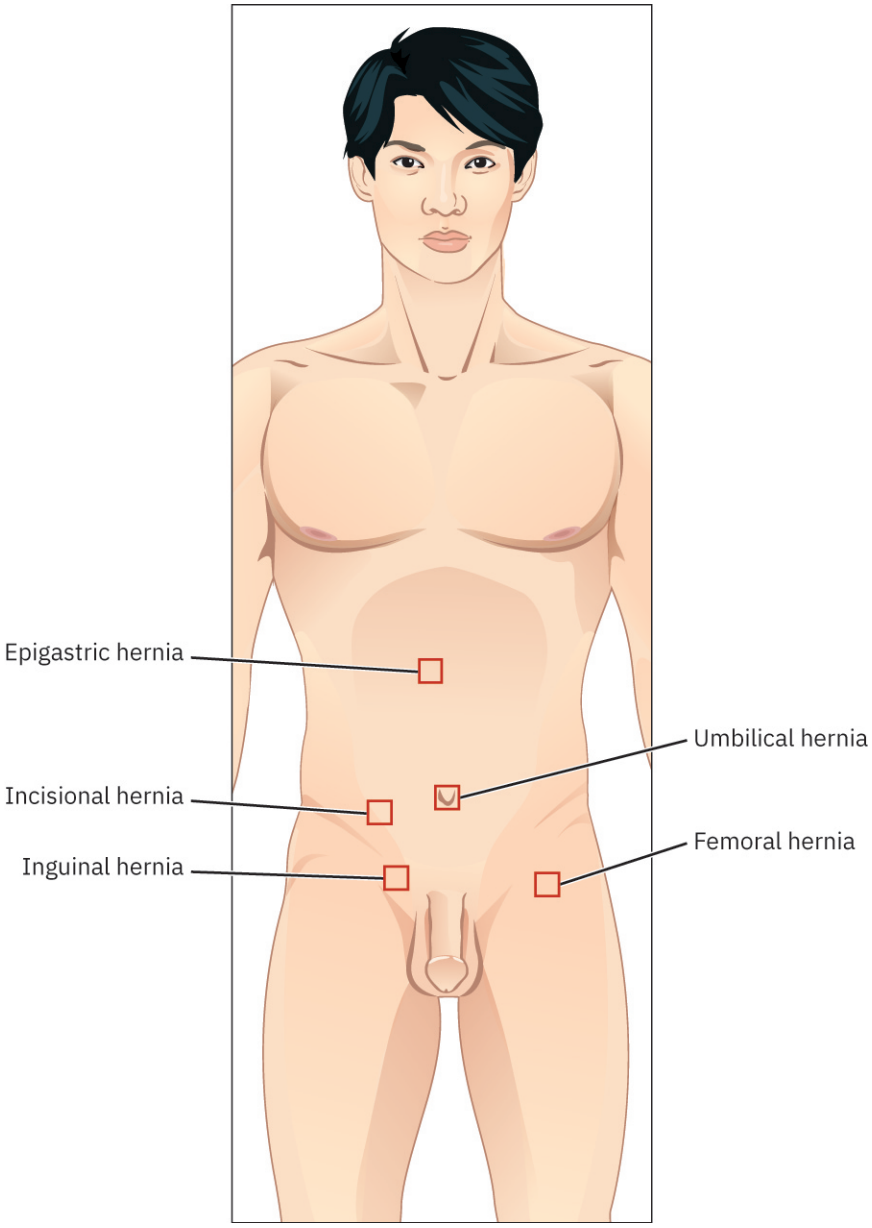

FIGURE 27.9 Hernias can occur in different areas of the body. (attribution: Copyright Rice University, OpenStax, under CC BY NC-SA 4.0 license)

Cause of Enlarged Abdominal Organs

The term **visceromegaly** refers to the abnormal enlargement of abdominal organs, such as the liver, stomach spleen, pancreas, or kidneys. This enlargement can be caused by a variety of diseases and conditions.

Enlarged Liver

The most common causes of **hepatomegaly** (enlarged liver) are:

- alcoholic liver disease. Excess consumption of alcohol can lead to liver inflammation and enlargement.
- cirrhosis: chronic liver damage, often from drug or alcohol use, that forms scar tissue in the liver, causing liver enlargement
- congestive heart failure. If the heart is unable to pump blood to the rest of the body, liver congestion may result, causing enlargement, in turn
- diseases: hematochromatosis, an excess of iron in the liver; Wilson's disease, an excess of copper in the liver; both cause liver enlargement
- hepatitis: viral infection (types A, B, and C) that causes swelling and inflammation of the liver

- infections: parasitic or bacterial that cause the inflammation and organ enlargement
- liver cancer
- nonalcoholic fatty liver disease: caused by an accumulation of fat either from obesity or metabolic syndrome

Enlarged Spleen

An enlarged spleen is called **splenomegaly**. Splenomegaly can cause an increased risk of rupture and subsequent hemorrhage. Therefore, the nurse must educate the patient that there should be no contact sports and physical limitations are needed. Splenomegaly can be caused by multiple conditions, including:

- autoimmune diseases (e.g., lupus, rheumatoid arthritis)
- blood disorders: diseases that affect the blood cells (e.g., lymphoma, leukemia, anemias)
- infections (e.g., viral and bacterial infections, malaria)
- inflammatory disorders (e.g., sarcoidosis)
- liver disease
- metabolic disorders(e.g., Gaucher disease, Niemann–Pick disease)
- traumatic injury

Aortic Aneurysm

An aortic aneurysm is a localized enlargement of the abdomen at the level of the abdominal aorta. A person may not have symptoms, but the danger is that if the aortic aneurysm bursts, it can be life threatening and require emergency medical attention. Risk factors that may contribute to an abdominal aortic aneurysm are increased age, smoking, high blood pressure, and a family history of abdominal aortic aneurysm.

LINK TO LEARNING

When a patient is experiencing an aortic aneurysm, conducting the physical exam is important to recognize the signs of this critical issue. This video (https://openstax.org/r/77aorticaneu) demonstrates what signs to look for during the exam if an aortic aneurysm is present.

Enlarged Kidney

The enlargement of a kidney is called **nephromegaly**. Common causes of nephromegaly include:

- congenital (from birth) abnormalities: occur when the kidney is larger than normal from birth
- glomerulonephritis: inflammation of the kidney's filtering system, which causes enlargement
- hydronephrosis: occurs when there is a backup of urine from the kidney that causes swelling; often caused by kidney stones, tumors, or structural abnormalities
- infections of the kidney: cause inflammation and swelling of the kidney
- polycystic kidney disease: genetic disorder in which multiple fluid-filled cysts grow on the kidney, causing enlargement

A healthcare provider may request a urinalysis and culture to test for infection, blood in the urine, or for different proteins and glucose.

Enlarged Gallbladder

An enlarged gallbladder can be caused by various conditions, including:

- biliary obstruction: tumors or structures in the bile ducts
- cholecystitis: inflamed gallbladder from infection
- gallstones: hardened deposits of the gallbladder that obstruct the bile flow of bile
- heart failure: often associated with liver enlargement, which leads to gallbladder distention
- pancreatitis: inflammation of the pancreas that leads to swelling of the surrounding areas, including the gall bladder

Stomach Cancer

Stomach cancer, or **gastric cancer**, occurs when abnormal cells grow rapidly in the lining of the stomach. The most common causes of stomach cancer are:

- age and sex: older adults and males are more prone to stomach cancer.
- chronic gastritis: inflammation of the stomach lining associated with *Helicobacter pylori*
- diet: diets high in salt, pickled foods, and smoked foods, and diets low in fruit and vegetables may increase risk of stomach cancer
- family history: familial history of stomach cancers
- *H. pylori* infections: long-term infection by this bacterium increases risk of stomach cancer
- previous stomach surgeries
- tobacco and alcohol use

Summary

27.1 Structure and Function

The external structure of the abdomen has dual functions: to assist the body in movement and to protect internal organs. The layers consist of skin, muscle, fat, and fascia. The abdomen is divided into four quadrants to provide a reference to the anatomic location of organs when signs and symptoms arise in the abdomen. Internal structures of the abdomen include vital organs and blood vessels that aid in digestion, metabolism, and overall body function.

The abdomen functions as a cavity to house vital organs of the digestive, endocrine, urinary, reproductive, and circulatory system. It also aids in functions such as maintaining intra-abdominal pressure (IAP), forced expiration, bladder emptying, vomiting, excretion, pregnancy, and childbirth.

Dysfunction of organs of the abdomen manifest in different ways. The patient may feel pain, experience bloating, have a change in bowel habits, or have abdominal distention. Reasons organs of the abdomen may not function correctly vary and include poor diet, lack of exercise, stress, reflux, and certain medications, among other issues. Impaired function of the abdomen can include abdominal pain, bloating, nausea, diarrhea, and constipation. Multiple organs and structures are contained within the abdomen, and abdominal issues can be caused by any of these.

27.2 Physical Assessment

A thorough assessment of the abdomen provides valuable information regarding the function of a patient's GI and GU systems. A focused GI and GU subjective assessment collects data about the signs and symptoms of GI and GU diseases, including any digestive or nutritional issues, relevant medical or family history of GI and GU diseases, and any current treatment for related issues. Information gained from the interview process is used to tailor the subsequent physical assessment and create a plan for patient care and education. Physical examination of the abdomen includes inspection, auscultation, palpation, and percussion. When assessing the abdomen, consider the organs located in the quadrant you are examining.

Visually examine the abdomen for overall shape, masses, skin abnormalities, and any abnormal movements. Auscultation is performed after inspection for more accurate assessment of bowel sounds and vascular sounds. Palpation of the abdomen involves using the flat of the hand and fingers (not the fingertips) to detect palpable organs, abnormal masses, or tenderness. Note the patient's response to palpation, such as pain, guarding, rigidity, or rebound tenderness. A technique to determine ascites is to check for a fluid wave. While assessing the abdomen, it is important to not only recognize normal findings but to recognize abnormalities as well.

Common alterations in bowel elimination include constipation, diarrhea, and bowel incontinence. Urinary tract infection, urinary incontinence, and urinary retention are common alterations in urinary elimination. Documentation should be described using the quadrants as a reference and should include data from inspection, auscultation, percussion, and palpation.

27.3 Recognizing Common Abdominal Disorders

Nurses must perform comprehensive abdominal assessment by collecting subjective and objective data. To appropriately assess the abdomen, it is imperative the assessment be completed in a look, listen, and feel order with the patient lying in a supine position. The most common causes for abdominal distention are the "5 Fs": fat, flatus, feces, fluid, and fetus. Assess for masses or bulges, which may indicate structural deformities like hernias or related disorders in abdominal organs. Visceromegaly is the abnormal enlargement of abdominal organs, such as the liver, stomach spleen, pancreas, or kidneys. This enlargement can be caused by a variety of diseases and conditions.

Key Terms

abdomen the anterior region of a person's trunk between the diaphragm and pelvis
aerophagia swallowing air
anorexia loss of appetite
bloating a feeling of fullness and tightness in the abdomen
borborygmus abdominal sound, described as stomach growling, heard without a stethoscope

caput medusae distended veins that extend from the umbilicus
constipation a condition characterized by uncomfortable, infrequent bowel movements
Cullen sign ecchymosis in the subcutaneous fatty tissue below the umbilicus, indicating hemorrhagic pancreatitis
defecation the process of eliminating waste from the body through the rectum and anus
diarrhea frequent, loose, watery stool
dysuria pain or discomfort with urination
ecchymosis bruising
emesis the forceful expulsion of the food contents out of the stomach through the mouth
fascia thin, fibrous connective tissue
flatulence intestinal gas passed through the rectum
fluid wave a test to check for free fluid in the abdomen
gastric cancer stomach cancer
Grey Turner sign ecchymosis along the flank associated with acute necrotizing pancreatitis
hematemesis vomiting of blood
hematochezia bloody stool
hepatomegaly enlarged liver
hernia an abdominal organ, usually the intestine, pushed through the muscle of the abdominal wall
hollow viscera organs that are hollow tubes or pouches
hyperactive bowel sounds may indicate bowel obstruction or gastroenteritis
hyperpnea forced breathing
hypoactive bowel sounds may be present with constipation, after abdominal surgery, peritonitis, or paralytic ileus
inferior vena cava (IVC) the body's largest vein; carries blood to the heart from the bottom half of the body back to the heart; located in the posterior abdominal wall to the right of the aorta
intra-abdominal pressure (IAP) the steady pressure within the abdominal cavity that occurs from the interaction of the abdominal wall and viscera
left lower quadrant (LLQ) houses the lower part of the large intestine (descending colon), sigmoid colon, and the left ovary and fallopian tube in females
left upper quadrant (LUQ) houses the stomach, the spleen, pancreas, portions of the small intestine and large intestine, and a portion of the liver
melena dark, tarry stools, often associated with upper gastrointestinal bleeding
nausea the sensation of discomfort and unease in the stomach that is often accompanied by the urge to vomit
naval umbilicus
nephromegaly enlarged kidney
peristalsis the wavelike movement of the gastrointestinal system to move contents forward
peritoneal space the layer of tissue that surrounds the abdomen
protuberant convex or bulging abdomen
rebound tenderness the clinician maintains pressure over an area of tenderness and then withdraws the hand abruptly; if the patient winces with pain upon withdrawal of the hand, the test is positive
right lower quadrant (RLQ) houses the appendix, part of the large intestine (cecum and ascending colon), the right ovary and fallopian tube in females
right upper quadrant (RUQ) houses the liver, gallbladder, and portions of the small intestine and large intestine
rigidity involuntary contraction of the abdominal musculature in response to peritoneal inflammation; it is a reflex the patient cannot control
scaphoid sunken abdomen
solid viscera solid organ
splenomegaly enlarged spleen
striae white or silvery elongated marks that occur when the skin stretches, especially during pregnancy or excessive weight gain
viscera an organ in the abdomen
visceromegaly the abnormal enlargement of abdominal organs
voluntary guarding voluntary contraction of the abdominal wall musculature, usually the result of fear, anxiety, or the touch of cold hands

Assessments

Review Questions

1. During an initial assessment, the patient admits to the nurse that she drinks alcohol daily and is now experiencing abdominal swelling in the RUQ. The nurse suspects enlargement of which organ?
   a. small intestine
   b. ovary
   c. liver
   d. rectum

2. A patient is asking why the nurse is concerned about appendicitis. The nurse explains that it is due to the pain the patient feels in which quadrant?
   a. LLQ
   b. RLQ
   c. RUQ
   d. LUQ

3. When examining your patient, she states she has been feeling full and has a constant acidic taste in her mouth when she lies down. What do you suspect that she might have?
   a. appendicitis
   b. anorexia
   c. diarrhea
   d. GERD

4. Your patient is older and has had frequent episodes of diarrhea from a possible virus. The caretaker states the patient is not taking in fluids well but is still having frequent bowel movements. What is your biggest concern?
   a. dehydration
   b. constipation
   c. bloating
   d. contractions

5. Your patient is complaining of hard stools when he has a bowel movement. After completing the patient interview, it is revealed he has a diet full of fast food and few whole grains, vegetables, or water. What do you suspect the constipation is due to?
   a. medication overuse
   b. lack of dietary fiber and water
   c. too much water and overeating of dietary fiber
   d. a GI virus

6. A nurse suspects a patient is having an acute pancreatic attack and possible hemorrhage, and needs to quickly assess the patient. What would be the best assessment technique?
   a. Inspect for Grey Turner sign.
   b. Auscultate for hyperactive bowel sounds in the LUQ.
   c. Palpate and percuss over the LRQ.
   d. Percuss in the RUQ to the midclavicular line to hear dullness.

7. A patient presents with a history of chronic alcohol abuse and has recently stated that he has noticed his “stomach swelling.” How would you best begin the assessment?
   a. Percuss for liver size in the RUQ and find the liver edge extends to the LUQ.
   b. Palpate for rebound tenderness of the bladder.
   c. Observe for borborygmi due to increased peristalsis from alcohol use.
   d. Observe for distended veins extending from the umbilicus.

8. A patient's physical assessment reveals hypoactive bowel sounds. What does the nurse recognize that this may be a clue to?
   a. diarrhea
   b. gastroenteritis
   c. peritonitis
   d. constipation

9. The nurse discovers the following findings during the assessment. What should be reported to the provider?
   a. The patient's abdomen appears flat and symmetric.
   b. There are hypoactive bowel sounds in all quadrants.
   c. Firmness is palpated in left lower quadrant.
   d. There is a scar from a previous appendectomy.

10. A 79-year-old female is seen in the emergency department for a "bump" she found on her lower abdomen. After various tests, the doctor tells her she has a hernia. The patient asks you what could have caused this. What answer do you provide?
    a. eating too much fiber in the diet
    b. hormone changes causing the muscles of the abdominal wall being too strong
    c. hormone changes causing the muscles of the abdominal wall being too weak
    d. undiagnosed *H. pylori* infection

11. An adult patient comes to the emergency department with abdominal distention. What finding supports the documentation of jaundice noted in the physical assessment?
    a. He is newly immigrated and has not had routine vaccines.
    b. He has yellowing of the skin and sclera.
    c. He is a nonsmoker.
    d. He is physically active and exercised regularly.

12. Your 65-year-old male patient comes in for a routine physical and part of the patient's history reveals a parent who died from gastric cancer. Your patient asks what he should do help lower his risk of gastric cancer. What is your response?
    a. Eat more pickled food; the acid will help cut fat from the diet.
    b. Increase fresh fruits and vegetables in your diet.
    c. You are not at risk because you are past the age of diagnosis.
    d. You are not at risk because it only affects women.

Check Your Understanding Questions

1. Why is the abdomen assessed in a different order than other body systems?
2. When documenting your findings, how do you describe objective findings?
3. When assessing the abdomen for abdominal distention, why is it important to get a history of a patient's stool pattern and current diet?
4. How can asking where a patient feels a bulge in the abdomen help pinpoint what type of hernia the person is experiencing?
5. When assessing the abdomen for distention, why does the nurse ask the patient to lie in a supine position?
6. When assessing the abdomen for different disorders, why is a diet history important?

Reflection Questions

1. Why is identifying the patient's pain in reference to one of the four quadrants important when assessing the abdomen?
2. Why is it important to ask about a patient's diet and medication intake when assessing the abdomen?

3. When trying to identify what is causing the patient's symptoms, such as diarrhea or constipation, what function of the abdomen should be recalled and what key questions should be asked?
4. What are important questions to ask during the patient interview that may be unique to the abdominal assessment?
5. How can pain be assessed during the abdominal exam for a patient who may be nonverbal?
6. When assessing for abdominal distention, how can one use the quadrant system on exam to narrow down organ involvement?
7. Why is obtaining the patient's activity and diet, alcohol use, and drug use history important to inquire about when assessing the abdomen for hernias and organ involvement?

What Should the Nurse Do?

A 23-year-old female presents to the emergency department with vomiting and abdominal pain. She describes it as "severe pain at her belly button" and is now radiating to the RLQ. The pain is described as cramping that started over 12 hours ago. She has had nausea and decreased appetite. She began vomiting this morning, which she states is mainly fluid because she has not been able to eat anything since yesterday. She denies any fever or changes in her stool.

1. Based on the description of the patient's pain and remembering the structures of the abdomen, what organs may be involved?
2. What are the impaired functions of the abdomen she is experiencing?
3. The patient asks to use the bathroom. When she returns, she tells you she had a bowel movement. What questions should you ask regarding defecation to add to the comprehensive abdominal assessment?
4. Is there any medical history you need to be aware of?
5. How should you approach gathering objective data during the patient exam?
6. The patient has sunken in eyes, dry lips, and dry mucous membranes. Because of the patient's history, what do you suspect is happening with the patient and what should you do next?

Competency-Based Assessments

1. Develop a poster presentation that explains the anatomic structures of the abdomen and their respective functions.
2. Refer to Table 27.3.
   What role do the abdominal organs play in the digestive process?
3. Perform an abdominal assessment on another person.
4. Make a list of five questions that should be asked during an abdominal assessment.
5. Review the competency checklist for this chapter and have a peer or instructor assess your performance of the tasks. You can find the checklists on the Student resources tab of your book page on openstax.org.

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CHAPTER 28

Clinical Judgment and Critical Thinking

FIGURE 28.1 Critical thinking in nursing is a goal-oriented, outcome-directed thought process used to improve patient care outcomes. (credit: modification of work "220202-A-QC081-993.JPG" Army Spc. Logan Ludwig/Joint Base San Antonio, Public Domain)

CHAPTER OUTLINE

28.1 Clinical Judgment Measurement Model
28.2 Developing Critical Thinking Skills
28.3 Unfolding Case Study Dissection

INTRODUCTION Picture this: You're a new graduate nurse fresh off orientation on a critical care unit. You get report on two of your patients, one of whom is on a ventilator after a head injury, and the other is being treated for heart failure. The nurse giving you report mentions that the patient with heart failure has been receiving a large dose of furosemide, a diuretic medication, and has been having some irregular heartbeats, according to the monitor. Reflecting on your nursing knowledge, you remember that abnormal potassium levels can affect the heart's rhythm, so you pull up the patient's chart to see what their potassium level is. The potassium level is very low, likely from the high dose of diuretics being administered. You quickly get in contact with the treating clinician to ask for a potassium replacement and regulate the patient's levels back to normal. Had you not made this connection, the patient could have experienced cardiac arrest or other life-threatening symptoms related to their low potassium level. You used your nursing knowledge to make a clinical judgment call that most likely saved your patient's life. The ability to critically think and exhibit clinical judgment in practice are imperative skills for nurses to have. This chapter explores the shift in nursing practice and education that is occurring currently to better prepare new graduates for situations like this.

28.1 Clinical Judgment Measurement Model

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Identify the purpose for development of the Clinical Judgment Measurement Model (CJMM)
- Explain how to apply the Clinical Judgment Measurement Model (CJMM) to the nursing practice

Historically, nursing was often viewed as a "task-oriented" career, meaning that nurses were to take orders from physicians without question and carry out nursing tasks. These tasks were usually simple, such as bed linen changes, helping patients use the toilet, and providing hygiene care. However, the profession of nursing has evolved into a more complex, autonomous career over the past several decades. Nurses now use **clinical judgment**, which is the thought process that allows nurses to arrive at a conclusion, based on objective and subjective information about a patient, to achieve positive patient outcomes. Many times, nurses are the care providers tasked with making clinical decisions that will significantly affect the lives of their patients. In recent years, nursing education has also evolved to better train nurses to critically think and use clinical judgment in practice. To achieve this, the clinical judgment measurement model (CJMM) was developed. This model allows nurse educators to teach, assess, and measure the development of clinical judgment skills of nursing students. It assists nursing students to connect knowledge learned in the classroom to provide exceptional clinical care in practice. This model is the new foundation for nursing critical thinking and skill development and is discussed in more detail throughout this chapter.

Purpose for Development of the CJMM

Before development of the CJMM, there was not a good way to measure the clinical judgment and decision-making skills of nursing students. Developing these skills was a priority focus of most nursing programs, but there was no tangible way to measure it to ensure it was being taught effectively. This was the basis for the development of the CJMM. Researchers at the National Council of State Boards of Nursing (NCSBN) used nursing literature and research studies, in combination with data analysis and input from nursing students, to develop the CJMM. This model is used not only as a teaching tool within nursing school curricula, it is also used as a guiding framework for the development of new types of questions on the National Council Licensure Examination (NCLEX) to assess nursing student's clinical judgment and critical thinking skills. By using the CJMM, nurse educators can be more confident that they are preparing nursing students to enter practice with a high level of critical thinking and the ability to make sound clinical judgments when caring for their patients. It also provides students with a structured approach for decision-making, improves students' decision-making, and supports quality and safety.

LINK TO LEARNING

You can learn more about the new NCLEX examination (https://openstax.org/r/77NCLEXexam) that incorporates concepts from the CJMM and get prepared for test day.

Comparing Different Nursing Process Models

Before development of the CJMM, the nursing process was "ADPIE," which stands for Assessment, Diagnosis, Planning, Implementation, and Evaluation. This nursing framework was developed in the 1950s and continues to be used in some capacity today, though most nursing schools have replaced it with the CJMM, which further expands the nursing process into more measurable components. A description of each of the steps of the original nursing framework is given in Table 28.1.

Steps	Description
Assessment	• Data can also be collected from electronic health records. • Data collection (both subjective and objective) • Data are collected from the patient directly and/or from family and caregivers in addition to physical assessment of the patient performed by the nurse.
Diagnosis	• Formulation of a nursing diagnosis • The International North American Nursing Diagnosis Association maintains a list of nursing diagnoses that can be used to describe a patient's situation. • Note that nursing diagnoses are separate from medical diagnoses; for example, a patient with a medical diagnosis of heart failure might have a nursing diagnosis of "decreased cardiac output."
Planning	• Goals and patient outcomes are developed. • Goals should be patient specific and mutually agreed upon with the nurse and patient. • Goals should be "SMART," meaning they are specific, measurable, attainable, realistic, and timely. • Nursing care plans are developed to ensure that care provided will help achieve patient goals.
Implementation	• Actions by the nurse • Carrying out the nursing interventions planned in the previous step (e.g., administering medications)
Evaluation	• Reassess patient after interventions are provided. • Determine whether patient goals have been met and if and how care plan needs to be revised.

TABLE 28.1 Steps of the Nursing Process

Using the nursing process has many benefits for nurses, patients, and other members of the healthcare team. The benefits of using the nursing process include:

- decreases omissions and duplications
- encourages collaborative management of a patient's healthcare problems
- identifies a patient's goals and strategies to attain them
- improves patient safety
- improves patient satisfaction
- increases the likelihood of achieving positive patient outcomes
- promotes quality patient care
- provides a guide for all staff involved to provide consistent and responsive care saves time, energy, and frustration by creating a care plan or path to follow

LINK TO LEARNING

Learn more about the CJMM (https://openstax.org/r/77CJMM) to explore new ways of testing clinical judgment in nursing as part of the NCLEX.

Application of the CJMM to Nursing Practice

There are several layers to the CJMM framework. Layer 0, at the top, is the broadest layer and the layers get more specific as the reach the bottom at layer 4. As nurses move through layers 2 through 4, they are working through a cognitive process that helps them make clinical decisions for patients, using clinical judgment to do so (as represented by the broad layers 0 and 1 at the top of the model). The more specific layers (2–4) are discussed in more detail in the following sections.

Form, Refine, and Evaluate Hypotheses

Layer 2 of the CJMM is composed of three different parts: form hypotheses, refine hypotheses, and evaluation. The nurse uses specific patient assessment findings ("cues") to develop hypotheses, or educated guesses, about the patient's condition. The nurse uses the cues in combination with their foundational clinical knowledge to determine potential explanations for the patient's situation. As more cues are assessed and more information about the patient is obtained, the nurse can refine their initial hypothesis and determine its accuracy. As the nurse moves through the steps in layers 3 and 4 to make clinical decisions, they are also checking in with the parts of this layer to continuously re-evaluate the plan of care. As you will read in the next section, each of the cognitive skills in layer 3 corresponds to a component of layer 2. As the nurse assesses and cares for a patient, they can determine whether their actions have satisfied the goals of care. If the goals are not satisfied, the nurse can move again through the steps in layers 3 and 4 to revise the care plan and make different clinical decisions that, hopefully, will assist in better meeting the patient's needs.

Application of Cognitive Skills

Layer 3 of the CJMM is composed of six steps that involve a repetitious process that improves with time and nursing experience. Eventually, these steps become second nature to a more experienced nurse, but they serve as a framework for nursing students and early-career nurses to use as a more deliberate guide for making clinical decisions. These six cognitive skill steps (also known as clinical judgment functions) are described in more detail in Table 28.2.

Cognitive Skill	Description
Recognize cues	• Assessment data are collected. These can be subjective from the patient or family or objective from physical assessment performed by the nurse. • Data can also be collected from the electronic health record. • Nurse uses these assessment data to look for cues that may be indicative of what is going on with the patient. • Nurse tries to determine what information is relevant, what is the most important, and if there is anything that is of immediate concern.
Analyze cues	• Nurse takes the assessment data collected from the previous step and considers how they relates to the patient's history and current situation. • Nurse considers whether the cues collected in the previous step are consistent with the patient's current condition, if any of the cues are immediately concerning, and if there are additional data that need to be collected. • Nurse attempts to link recognized cues to the patient's clinical presentation and establish probable patient needs, concerns, or problems.
Prioritize hypotheses	• Nurse examines all possibilities for the patient's situation based on collected cues. • Nurse determines which possibilities are most likely, which are most serious, and which are the highest priority to treat first. • Priorities of care are established on the basis of the patient's current health problems and cues assessed in the first two steps.

TABLE 28.2 Cognitive Skills in the CJMM

Cognitive Skill	Description
Generate solutions	• Using hypotheses for the patient's condition from the previous step, nurse plans specific actions to achieve goals and outcomes. • Actions can be classified as "indicated," "contraindicated," or "nonessential" to help determine priority actions. • During this step, the nurse should identify outcomes that are expected with each nursing action and plan care that addresses patient's current needs.
Take action	• Nurse performs interventions, which may be further assessment, monitoring, teaching, or actual interventions, depending on the patient's needs. • Actions are based on nursing knowledge, priorities of care, and planned outcomes to achieve optimal health outcomes for the patient.
Evaluate outcomes	• Nurse reviews patient response to actions and interventions. • Nurse compares observed outcomes with expected outcomes to determine if the plan of care needs to be revised.

TABLE 28.2 **Cognitive Skills in the CJMM**

Expected Responses and Behaviors

For each cognitive skill, there are specific responses and behaviors the nursing student is expected to exhibit. When expected responses are performed by the student, it indicates that the cognitive skill has been adequately demonstrated, thus the student is using clinical judgment effectively. Expected responses and behaviors by the student that would indicate they can successfully recognize cues include recognizing assessment data pertinent to the patient's condition, identifying subtle changes in the patient's condition, and using knowledge and experience to thoroughly assess the patient.

To analyze cues, it is expected that the student can recognize abnormal assessment findings, anticipate patient needs, identify potential complications that may arise, and begin to prioritize patient problems. When prioritizing hypotheses, the student nurse should be able to organize data and findings based on patterns and trends and prioritize the patient's goals and needs. During the generate solutions (planning) step, the student nurse is expected to collaborate with the interprofessional care team to establish goals of care, prioritize nursing interventions based on the patient's needs, and continuously modify the plan of care based on patient condition changes. When the student begins to the take action step, it is expected that they will accurately perform nursing interventions based on previously established patient priorities and needs, document care appropriately, and provide education to the patient and family. When evaluating outcomes, expected behaviors include reassessing the patient's condition to determine whether goals and outcomes have been met, evaluating how effective nursing interventions were, and modifying patient goals and priorities as needed.

Consideration of Factors

While using clinical judgment to make practice decisions, it is important to do so within the context of environmental and individual factors. These factors are specific to each patient and help the nurse make informed, personalized decisions.

Environmental Factors

Environmental factors are things within the external environment that may affect the clinical decision-making process. These factors include:

- culture (e.g., diet, religion, language, literacy)
- individual medical information, including medical history, laboratory and diagnostic test results, intake and output, medications, and current treatments
- patient demographics

- resources (e.g., supplies, staffing, open beds)
- setting (e.g., hospital, long-term care, community health center)
- situational factors (e.g., safety considerations, available equipment, surroundings)
- time pressure related to emergent orders and changes in patient condition

CULTURAL CONTEXT

Cultural Context within the CJMM

Cultural factors must be considered as part of the clinical judgment process. Without this context, it may be difficult to ascertain the cause of the patient's condition. For example, in some cultures, a vegetarian diet is common. In the context of this factor, the nurse must consider that a lack of protein and vitamin B12 may be the cause of certain medical issues within this population. Although considering cultural factors is important, it is even more important not to generalize information about cultures, because this can border on perpetuating stereotypes. There is a difference between generalizing information about all members of a population versus asking questions about the patient's culture to get specific information that can help the nurse make informed clinical decisions.

Individual Factors

Individual factors that must be considered during the clinical judgment process are more related to the nurse than the patient. These factors include:

- cognitive load of the nurse (e.g., demands, job stress, problem solving skills, memory)
- nurse characteristics, including attitudes, prior experiences, amount of nursing experience
- nurse specialty, knowledge, and skills

REAL RN STORIES

Floating to Different Units: Considering the Nurse's Experience

Nurse: Gabby, BSN
Clinical setting: Medical-surgical unit
Years in practice: 3
Facility location: Small community hospital in rural Georgia

After clocking in for my shift, I was notified by the charge nurse that I would be floating to a different unit for the night. She told me I would need to go to the labor and delivery unit to help out because there were several patients being admitted who would be delivering babies that night. I had only ever worked on a medical-surgical unit, so I expressed that I was concerned and uncomfortable taking care of this patient population. The charge nurse shrugged her shoulders and informed me I was floating to the unit anyway.

Once I got to the unit, the labor and delivery charge nurse told me I would be taking care of a patient who had just delivered a baby 2 hours ago. I again expressed my discomfort, because I had never taken care of postpartum mothers or babies. The charge nurse seemed surprised by this and stated, "I was told they were sending down a nurse with obstetrics experience. Let me make a call real quick."

When the charge nurse came back from making her phone call, she informed me that there had been a mistake and a different nurse with obstetrics experience was supposed to float to the unit, not me. I breathed a huge sigh of relief and headed back to my home unit, thankful that I advocated for myself and the patients.

28.2 Developing Critical Thinking Skills

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Analyze the types of thinking used in nursing
- Recognize when to use the different types of thinking in nursing
- Explore the application of knowledge to thinking in nursing
- Appy Critical Thinking Indicators (CTIs) to decision making

Thinking is something we usually do subconsciously, because we are not usually "thinking about thinking." However, with the ever-increasing autonomy being afforded to nurses, there is also an increased need for nurses to be able to critically think effectively and intentionally. Being able to critically think helps nurses' problem solve, generate solutions, and make sound clinical judgments that affect the lives of their patients. Keep reading to learn more about how nurses use critical thinking in practice and how you can develop your own critical thinking skills.

Types of Thinking Used in Nursing

Nurses make decisions while providing patient care by using critical thinking and clinical reasoning. In nursing, **critical thinking** is a broad term that includes reasoning about clinical issues such as teamwork, collaboration, and streamlining workflow." On the other hand, **clinical reasoning** is defined as a complex cognitive process that uses formal and informal thinking strategies to gather and analyze patient information, evaluate the significance of this information, and weigh alternative actions. Each of these types of thinking is described in more detail in the following sections.

Cognitive Thinking

The term **cognitive thinking** refers to the mental processes and abilities a nurse uses to interpret, analyze, and evaluate information in their practice. Basically, it encompasses how nurses think about the practice decisions they are making. Cognitive thinking and critical thinking go hand in hand because nurses must be able to use their knowledge and mental processes to devise solutions and actions when caring for patients. Using critical thinking means that nurses take extra steps to maintain patient safety and do not just follow orders. It also means the accuracy of patient information is validated and plans for caring for patients are based on their needs, current clinical practice, and research. Critical thinkers possess certain attitudes that foster rational thinking:

- confidence: believing in yourself to complete a task or activity
- curiosity: asking "why" and wanting to know more
- fair-mindedness: treating every viewpoint in an unbiased, unprejudiced way
- independence of thought: thinking on your own
- insight into egocentricity and sociocentricity: thinking of the greater good and not just thinking of yourself. Knowing when you are thinking of yourself (egocentricity) and when you are thinking or acting for the greater good (sociocentricity)
- integrity: being honest and demonstrating strong moral principles
- intellectual humility: recognizing your intellectual limitations and abilities
- interest in exploring thoughts and feelings: wanting to explore different ways of knowing
- nonjudgmental: using professional ethical standards and not basing your judgments on your own personal or moral standards
- perseverance: persisting in doing something despite it being difficult

Cognitive thinking is significant to nursing because it provides a foundation on which nurses can make rapid and accurate decisions in clinical practice. Nurses must be able to think quickly and make informed decisions to promote optimal patient outcomes.

Effective Thinking

To make sound judgments about patient care, nurses must generate alternatives, weigh them against the evidence, and choose the best course of action. The ability to clinically reason develops over time and is based on knowledge and experience. Inductive and deductive reasoning are important critical thinking skills. They help the nurse use clinical judgment when implementing the nursing process. Effective thinking in nursing involves the integration of clinical knowledge and critical thinking to make the best decisions for patients. For example, if a nurse was caring

for a patient who presents with hypertension and new-onset left-sided weakness, it is important that the nurse be able to quickly consider potential causes for the weakness and implement immediate stroke protocols. Without the ability to critically think, the nurse may overlook the weakness as being unrelated to the hypertension and not consider the possibility of stroke, leading to a poor patient outcome. Thus, it is imperative that nurses develop effective thinking skills.

Inductive Reasoning

The term **inductive reasoning** involves noticing cues, making generalizations, and creating hypotheses. Cues are data that fall outside of expected findings and give the nurse a hint or indication of a patient's potential problem or condition. The nurse organizes these cues into patterns and creates a generalization. A **generalization** is a judgment formed on the basis of a set of facts, cues, and observations and is similar to gathering pieces of a jigsaw puzzle into patterns until the whole picture becomes clearer. On the basis of generalizations created from patterns of data, the nurse creates a hypothesis regarding a patient problem. Remember, a **hypothesis** is a proposed explanation for a situation. It attempts to explain the "why" behind the problem that is occurring. If a "why" is identified, then a solution can begin to be explored. No one can draw conclusions without first noticing cues. Paying close attention to a patient, the environment, and interactions with family members is critical for inductive reasoning. As you work to improve your inductive reasoning, begin by first noticing details about the things around you. Be mindful of your five primary senses: the things that you hear, feel, smell, taste, and see. Nurses need strong inductive reasoning patterns and be able to act quickly, especially in emergency situations. They can see how certain objects or events form a pattern (or a generalization) that indicates a common problem.

Consider this example: A nurse assesses a patient who has undergone surgery and finds the surgical incision site is red, warm, and tender to the touch. The nurse recognizes these cues form a pattern of signs of infection and creates a hypothesis that the incision has become infected. The provider is notified of the patient's change in condition, and a new prescription is received for an antibiotic. This is an example of the use of inductive reasoning in nursing practice.

Deductive Reasoning

Another type of critical thinking is **deductive reasoning**; it is referred to as "top-down thinking." Deductive reasoning relies on using a general standard or rule to create a strategy. Nurses use standards set by their state's Nurse Practice Act, federal regulations, the American Nursing Association, professional organizations, and their employer to make decisions about patient care and solve problems.

Think about this example: On the basis of research findings, hospital leaders determine patients recover more quickly if they receive adequate rest. The hospital creates a policy for quiet zones at night by initiating no overhead paging, promoting low-speaking voices by staff, and reducing lighting in the hallways. The nurse further implements this policy by organizing care for patients that promotes periods of uninterrupted rest at night. This is an example of deductive thinking, because the intervention is applied to all patients regardless of whether they have difficulty sleeping or not.

Identify the Purpose of Thinking

Rationalizing the purpose of thinking is probably not something you do often, but it is the foundational first step in critical thinking. To effectively use critical thinking in practice, the nurse must first identify the purpose of thinking. For example, the nurse is caring for a patient who presents with fever, tachycardia, and shortness of breath. The patient also has an open, infected wound on the left foot that is not healing. The nurse must recognize that the patient is exhibiting signs and symptoms that may be indicative of an underlying problem. At this point, the nurse must be able to identify that the purpose of thinking with regard to the patient is to consider what might be happening with the patient and formulate a plan of care. This begins the process of critical thinking, which involves several steps: thinking ahead, thinking in action, and reflection on thinking.

Thinking Ahead

Thinking ahead in nursing involves considering what may be going on with the patient to anticipate potential outcomes and complications that may arise. Remember competent nurses are proactive versus reactive. Reactive nursing is letting situations arise and then responding to the change, but proactive nursing is recognizing cues behaviors and patterns that are leading up to a complicated event. Additionally, the nurse will formulate goals of

care and must try to anticipate specific needs the patient will have. Considering the patient discussed in the preceding paragraph, the nurse should begin the process of thinking ahead about potential outcomes and complications. The nurse may hypothesize that the patient is starting to develop sepsis from the open wound on the foot so severe sepsis and/or septic shock could be a complication to begin preparing for. The nurse thinks ahead about goals of care for the patient and determines that wound care to prevent infection spread and sepsis is the priority goal at this time.

Thinking in Action

Thinking in action encompasses the thought processes occurring while the nurse is performing interventions. So, if the nurse in our example begins performing wound care, they are thinking about the best dressing to use, how to clean the wound, and if antibiotics should be considered. All of these thoughts are likely occurring as the nurse is providing the care; thus, they are examples of how the nurse is using thinking in action.

Reflection on Thinking

After performing interventions or making decisions, the nurse should reflect on the thinking that occurred. The nurse will use this thinking process to determine if the decision was reactive or responsive. Reactive decision-making involves responding to situations after they have occurred, often in a hurried or unplanned manner. These decisions tend to be impulsive and are driven by immediate needs or crises. Responsive decisions, on the other hand, involve careful deliberation about how to address a situation based on careful consideration of information. In our example, the nurse's decision appears to have been responsive. The patient was exhibiting some altered vital signs, but nothing indicated that the situation had become emergent yet. The nurse was able to think carefully about the patient's situation and determine that wound care was the highest priority and begin to implement care in a calm, deliberate manner. In an ideal world, all nursing decisions would be responsive, but in a lot of cases, they must be reactive because of situation severity and medical emergencies.

Application of Knowledge

During the outset of the critical thinking process, nurses must judge whether their knowledge is accurate, complete, factual, timely, and relevant. This can be done by applying knowledge to nursing practice in a multitude of ways, including drawing from past education and experience in nursing and using professional resources and standards. Each of these is discussed in more detail in the following sections.

Knowledge Base

Becoming a nurse requires years of schooling, which contributes to the development of a robust knowledge base. Nurses receive formal education and training that provides them foundational knowledge in anatomy, physiology, pharmacology, and patient care techniques, among many others. Additionally, nurses are required to complete continuing education courses specific to their chosen practice setting, further developing their knowledge base. When applying knowledge in practice, nurses can draw from their knowledge base and make informed decisions about patient care.

Experience in Nursing

Nursing is considered a practice. Nursing practice means we learn from our mistakes and our past experiences and apply this knowledge to our next patient or to the next population we serve. As nurses gain more experience, they can use what they have learned in practice and apply it to new patient situations. Each new encounter with a patient presents unique challenge and learning opportunities that contribute to the development of clinical expertise. Reflecting on these experiences allows nurses to recognize patterns, anticipate patient outcomes, and refine their decision-making processes. Whether they are identifying effective nursing interventions for common conditions, adapting care plans to individual patient needs, or navigating complex situations with compassion, nurses draw upon their accumulated knowledge base from clinical experience to provide high-quality, patient-centered care. Through reflection and continuous learning from past experiences, nurses enhance their clinical skills, ultimately improving patient outcomes.

Professional Resources and Standards

In addition to foundational knowledge bases and experience, nurses can also use professional resources and standards to gain and apply knowledge in practice. Nurses can refer to clinical practice guidelines that have been established by professional organizations and healthcare institutions to help provide a framework for implementing

nursing interventions based on the best evidence. By following the guidelines, nurses are ensuring that their care aligns with established standards and promotes optimal patient outcomes. Additionally, nurses should remain up to date about new and emerging research in their practice area, which can be obtained by reading professional journals and publications and attending conferences, workshops, and other trainings. Nurses can use the information learned from these resources to influence practice and ensure the highest standards of care are being performed in their practice setting. By staying informed about the latest developments in nursing and health care, nurses enhance their knowledge base and can adapt their practice to incorporate new evidence and innovations. Along with professional development and staying current with professional practices, nursing students should actively seek and join professional organizations such as critical care nursing or oncology nursing societies because this will lead the student to become expert in that subject and stay relevant with current evidence and practice guidelines.

CLINICAL SAFETY AND PROCEDURES (QSEN)

QSEN Competency: Evidence-Based Practice

Definition: Providing quality patient care based on up-to-date, theory-derived research and knowledge, rather than personal beliefs, advice, or traditional methods.

Knowledge: The nurse will describe how the strength and relevance of available evidence influences the choice of intervention in provision of patient-centered care.

Skill: The nurse will:

- subscribe to professional journals that produce original research and evidence-based reports related to their specific area of practice
- become familiar with current evidence-based clinical practice topics and guidelines
- assist in creating a work environment that welcomes new evidence into standards of practice
- question the rational for traditional methods of care that result in sub-par outcomes or adverse events

Attitude: The nurse will appreciate the importance of regularly reading relevant professional journals.

Critique of Decision

After determining the best course of action based on the application of knowledge, the nurse can critique the decisions that were made. Specifically, the nurse will use self-reflection to review their actions and thoughts that led them to the decision. The nurse will consider the outcomes of their chosen interventions, reflect on the effectiveness of their approach, and identify areas of improvement. Additionally, the nurse may seek feedback from colleagues to obtain different perspectives about decisions made. Soliciting input from others helps the nurse gain insight and learn from their peers to further inform their future practice. Reflection questions that the nurse may ask themselves to critique their decision include the following:

- Was the patient goal or outcome met?
- Could the intervention have been done differently? Could it have been done better?
- What are alternative decisions that could have been made? What are the merits of each?

Critical Thinking Indicators

Certain behaviors that demonstrate the knowledge, skills, and attitudes that promote critical thinking are called **critical thinking indicators (CTIs)**. Critical thinking indicators are tangible actions that are performed to assess and improve your thinking skills.

4-Circle CT Model

There are many models and frameworks within nursing and other disciplines that attempt to explain the process of critical thinking. One of the most popular is Alfaro-LeFevre's 4-Circle CT Model (Alfaro-LeFevre, 2016). This model breaks critical thinking into four components: personal characteristics, intellectual and cognitive abilities, interpersonal abilities and self-management, and technical skills. These four components overlap, forming interconnections in critical thinking.

LINK TO LEARNING

Learn more here about the 4-Circle CT Model (https://openstax.org/r/77circle) and see an illustration of it.

Personal Critical Thinking Indicators

Personal CTIs are behaviors that are indicative of critical thinkers. Some of these behaviors that are most relevant to nursing include:

- confidence and resilience: showing ability to reason and learn and overcoming problems
- curiosity and inquisitiveness: asking questions and looking for the "why" behind things
- effective communication: listening well, showing understanding for others thoughts and feelings, and speaking and writing with clarity
- flexibility: changing approaches as needed to obtain the best results
- honesty: looking for the truth and demonstrating integrity while adhering to moral and ethical standards
- self-awareness: being able to identify one's own knowledge gaps and acknowledge when thinking may be negatively influenced by emotions or self-interests.

Personal Knowledge and Intellectual Skills

Personal knowledge and intellectual skills encompass the knowledge gained from nursing school and clinical experiences. Examples of each of these kinds of skills are listed in Table 28.3.

Personal Knowledge	Intellectual Skills
• Behavioral health and disease management • Ethical and legal principles • Normal and abnormal function (biological, psychological, social, cultural, and spiritual) • Nursing and medical terminology • Nursing process and theories • Related anatomy, physiology, and pathophysiology • Risk management and infection control • Safety standards • Scope of nursing practice • Signs and symptoms of common problems and complications • Spiritual, social, and cultural concepts	• Assesses systematically and comprehensively • Communicates effectively • Determines individualized outcomes and uses them to plan and provide care • Distinguishes normal from abnormal; identifies risks for abnormal • Distinguishes relevant from irrelevant; clusters relevant data together • Identifies assumptions and inconsistencies; checks accuracy and reliability (validates data) • Identifies problems and their underlying cause(s) and related factors • Reassesses to monitor outcomes (responses) • Recognizes changes in patient status; takes appropriate action • Recognizes missing information; gains more data as needed. • Sets priorities and makes decisions

TABLE 28.3 **Personal Knowledge and Intellectual Skills Included in the 4-Circle CT Model**

Interpersonal and Self-Management Skills

Interpersonal and self-management skills encompass the knowledge and skills needed for effective collaboration. These include:

- addressing conflicts fairly
- advocating for patients, self, and others
- dealing with complaints constructively
- establishing empowered partnerships
- facilitating and navigating change
- fostering positive interpersonal relationships and promoting teamwork

- giving and taking constructive criticism
- leading, motivating, and managing others
- managing stress, time, and energy
- promoting a learning and safety culture
- upholding healthy workplace standards
- using skilled communication in high-stake situations

Technical Skills

Technical skills in nursing refer to the practical abilities and competencies that nurses use in the delivery of patient care. These skills are typically learned through education, training, and hands-on experience. Some common technical skills in nursing include:

- administering medications
- assisting with personal hygiene and activities of daily living
- documentation and charting
- inserting intravenous catheters
- inserting urinary catheters and nasogastric tubes
- performing tracheostomy care
- performing wound care
- taking vital signs

28.3 Unfolding Case Study Dissection

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Examine the clinical decisions based on patient needs in the case study
- Recognize steps in application of patient care in the case study
- Identify patient care outcomes in the case study

In this section, we will examine the critical thinking and clinical decision-making used in Unfolding Case Study #3, previously provided in Chapter 15 General Survey, Anthropometric Measurement, and Vital Signs, Chapter 17 Nutrition Assessment, Chapter 18 Oxygenation and Perfusion, Chapter 19 Fluids, Electrolytes, and Elimination, and Chapter 24 Assessment of the Cardiovascular and Peripheral Vascular System.

UNFOLDING CASE STUDY

Unfolding Case Study #3

Mrs. Ramirez, a 68-year-old female, is brought to the emergency room by her husband. The patient reports shortness of breath with exertion and feeling “off” for the past 3 days.

Past Medical History	Patient reports shortness of breath "gets worse with walking and only gets better after sitting down for at least 15 minutes." **Medical history:** Myocardial infarction with stents 10 years ago, heart failure, COPD [chronic obstructive pulmonary disease], GERD [gastroesophageal reflux disease], and hypertension **Family history:** Married for 50 years, three grown children. Mother deceased from Alzheimer disease. Father alive, with hypertension and prostate cancer, currently undergoing treatment. **Social history**: Former 1 pack/day smoker, quit 20 years ago. Social drinker, 1 drink/week **Allergies:** None **Current medications:** • aspirin 81 mg PO [by mouth] daily • carvedilol 6.25 mg PO twice daily • furosemide 40 mg PO daily • lisinopril 10 mg PO daily
Assessment	**1130:** **General survey:** Alert and oriented ×4. Patient appears short of breath and anxious, leaning forward to assist with breathing. Skin is pale.
Assessment	**1200:** **Neurological:** Alert and oriented ×4, Glascow Coma Scale score 15 **HEENT** [head, eyes, ears, nose, and throat]**:** Within normal limits **Respiratory:** Accessory muscle use, tripod positioning, crackles in lung bases, fingernail clubbing noted **Cardiovascular:** Weak, thready pulse. 1+ pitting edema of bilateral lower extremities **Abdominal:** Within normal limits **Musculoskeletal:** 4/5 muscle strength of right arm, all other extremities 5/5 **Integumentary:** Skin pale but dry and intact
Provider's Orders	**1215:** Admit to medical-surgical unit for observation Continuous ECG [electrocardiographic] monitoring Start home medications Supplemental oxygen to maintain saturation >90 percent Vital signs every 4 hours
Flow Chart	**1230:** Blood pressure: 142/78 mm Hg Heart rate: 112 beats/minute Respiratory rate: 29 breaths/minute Temperature: 99.6°F (37.5°C) Oxygen saturation: 82 percent on room air Pain: 3/10 with breathing Weight: 221 lb. (102.2 kg) Height: 5 ft. 5 in. (1.6 m)
Nursing Notes	**1300:** While collecting the patient's weight, she expresses concern about her weight. She states, "I know I'm not at a healthy weight, but it's just so hard to eat healthy. Healthy food is so expensive."

Flow Chart	**1400:** Blood pressure: 137/76 mm Hg Heart rate: 105 beats/minute Respiratory rate: 25 breaths/minute Temperature: 99.6°F (37.5°C) Oxygen saturation: 92 percent on 2 L nasal cannula Pain: 3/10 with breathing
Nursing Notes	**1600:** When asked about diet, patient reports eating out for most meals. She states, "I just don't have time to cook. It's much easier to grab a burger on the way home. I work crazy hours, so by the time I get home, all I want to do is eat my burger and go to bed. No way I could cook after a work shift."

Clinical Decisions Based on Patient Needs

Referring to the scenario in Unfolding Case Study 3, as soon as the patient arrived at the emergency room, the nurse began the process of critically thinking about what needed to be done. The nurse assessed the patient's situation and then recognized, analyzed, and prioritized the patient's needs. Once the needs were prioritized, the nurse made clinical decisions about care to be provided and developed and refined planned nursing interventions. Each of these actions by the nurse is discussed in more detail in the following sections.

Assessment of Patient Situation

The nurse began to assess the patient as soon as they arrived at the hospital. The patient's chief complaint about shortness of breath and feeling "off" were important cues to notice because this was what brought them to the hospital for care. Additionally, another important cue that was recognized by the nurse was the patient's past medical history, which the nurse hypothesized might have been relevant to their symptoms. Specifically, the nurse took note of all medications the patient was currently taking, because that often provides even more information about a patient's situation. The nurse noticed that the patient was anxious and leaning forward, which is another important cue to recognize, because it was consistent with the patient's chief complaint of shortness of breath. During the assessment, the nurse obtained more information including a Glasgow Coma Scale assessment to use as a baseline comparison later and an assessment of the patient's mobility and functional status.

Recognize, Analyze, and Prioritize Patient Needs

The nurse recognized that the most concerning vital signs were the low oxygen saturation and elevated respiratory rate. Because airway and breathing are always the top priority, the nurse implemented interventions to address those issues first. To start, the nurse re-measured the vitals signs, double checked that the pulse oximeter was working correctly, and made sure the patient was not wearing fingernail polish, which can skew the readings. After rechecking the vitals signs, the nurse contacted the treating provider to report the findings. The nurse anticipated that the provider would order supplemental oxygen to improve the oxygen saturation level and maybe antianxiety medication to slow the patient's breathing rate. The patient also expressed concern about her weight gain and reported unhealthy eating habits; however, these were not the priority concerns at the time. The nurse chose to address those issues later because they were not as important as stabilizing the patient's respiratory status.

Develop and Refine Interventions

On the basis of the provider's orders, the nurse initiated continuous ECG monitoring and saw on the monitor that the patient was experiencing sinus tachycardia. The nurse also applied supplemental oxygen via nasal cannula, based on the provider's order to keep the oxygen saturation greater than 90 percent. Other nursing interventions included admitting the patient to the medical-surgical unit, restarting home medications, and taking vital signs every 4 hours. As you can see from the new vitals signs data, after applying oxygen, nearly all parameters were improved. If they did not show improvement, the nurse would have revised the plan of care and refined interventions to treat the patient's condition more effectively.

Application of Nursing Care

Application of nursing care in the case study included the interventions mentioned in the previous section as well as counseling the patient on dietary habits. Once the patient's physical condition was stabilized, the nurse addressed the patient's concerns about her weight gain. The nurse used an online calculator to determine the patient's body mass index, which was found to be 36.8. This indicated obesity, which the nurse recognized as being clinically significant and contributing to cardiac issues.

Incorporate Factors Affecting Patient Care

The nurse recognized that finances may have been a contributing factor to the patient's weight gain. The patient reported that it is hard for her to eat healthy food because it is expensive, indicating that her economic status affects her weight. Other contributing factors the nurse hypothesized may be involved included sociocultural or lifestyle behaviors that may result in overeating or unhealthy eating habits. Additionally, the nurse hypothesized that the patient may not have easy access to healthy foods, making it even more difficult to eat foods that promote a healthy body weight.

Revise Application of Care

The nurse planned to gather more information about these factors that may be contributing to the patient's obesity and to gauge the her willingness to make dietary and lifestyle changes that would support a healthier body weight. The nurse also planned to counsel the patient about eating habits and limiting eating out when possible as a way to control sodium intake, because of the patient's hypertension. The patient was provided information about healthy eating, including eating a large variety of foods, choosing healthy proteins, drinking lots of water, limiting salt and alcohol intake, and avoiding processed foods. The patient in the case study expressed a willingness to make healthy lifestyle changes, but if she had not, the nurse could revise the plan of care to focus patient education on other topics that were more amenable to the patient's self-reported health and dietary needs.

Evaluate Outcomes

After performing interventions, the nurse evaluated outcomes by assessing the patient's vital signs and her understanding of provided education. By assessing these parameters, the nurse was evaluating previous nursing actions that had been taken.

Evaluate Nursing Actions

Specifically, the nurse evaluated the action of applying supplemental oxygen by assessing the patient's vital signs. The nurse noticed that the patient's oxygen saturation went up to 92 percent after applying 2 L of oxygen via nasal cannula. This finding indicated that this intervention and nursing action were effective. Additionally, the nurse noticed that the patient's heart rate, blood pressure, and respiratory rate all improved slightly, further confirming that supplemental oxygen was an effective nursing action. To assess the patient's understanding of the provided education, the nurse had the patient "teach back" the information, asking them to also list out healthy alternatives to eating out that the patient was willing to try.

Revise Plan of Care

The nursing interventions were successful, as indicated by the improvement in vital signs. If they had not improved, the nurse would have revised the plan of care to treat the patient's condition more effectively. This may have included alerting the provider about the lack of improvement in the patient's condition, increasing the flow of supplemental oxygen, or educating the patient about deep breathing exercises to improve respiratory status. The nurse was continually assessing the patient's condition, monitoring for signs of worsening or improvement to use as a guide for revising the plan of care as necessary.

Summary

28.1 Clinical Judgment Measurement Model

Historically, nursing was often viewed as a task-oriented career, but in recent years, the profession has grown in terms of autonomy and clinical judgment. Some of this growth was due to the development of the CJMM, a tool designed to measure critical thinking and clinical judgment in nursing students. This tool allows educators to assess the development of nursing student's critical thinking skills to help ensure they are ready to practice as a nurse after graduation. This tool involves several steps that have expanded upon the traditional nursing process model, making it an excellent framework to guide new nurses in making clinical judgment calls in practice.

28.2 Developing Critical Thinking Skills

Nursing involves several types of thinking, of which one of the most important is critical thinking. Critical thinking involves applying knowledge to make care decisions that reflect evidence-based practice and consider patient preferences. Thinking is a subconscious process, but there are several models that have been developed to focus upon developing more improved thinking skills. Specifically, the 4-Circle CT model demonstrates characteristics that are vital to develop critical thinking skills. The development of critical thinking skills is especially important within nursing because nurses are constantly making clinical judgment calls when caring for sick patients.

Key Terms

clinical judgment thought process that allows nurses to arrive at a conclusion based on objective and subjective information about a patient

clinical judgment measurement model (CJMM) a model allowing nurse educators to teach, assess, and measure the development of clinical judgment skills of nursing students

clinical reasoning a complex cognitive process that uses formal and informal thinking strategies to gather and analyze patient information, evaluate the significance of this information, and weigh alternative actions

cognitive thinking mental processes and abilities a nurse uses to interpret, analyze, and evaluate information in their practice

critical thinking reasoning about clinical issues such as teamwork, collaboration, and streamlining workflow

critical thinking indicators (CTIs) certain behaviors that demonstrate the knowledge, skills, and attitudes that promote critical thinking

deductive reasoning type of thinking that involves using a general standard or rule to create a strategy

generalization proposed explanation for a situation

hypothesis judgment formed from a set of facts, cues, and observations

inductive reasoning type of thinking that involves noticing cues, making generalizations, and creating hypotheses

Assessments

Review Questions

1. What best describes the purpose of the CJMM?
    a. to help new graduates become critical care nurses after graduation
    b. to measure the ability of nursing students to take the NCLEX exam
    c. to help nursing students develop their clinical judgment skills
    d. to make sure that new nurses know how to run a code blue

2. The emergency room nurse is caring for a patient who presents with cough and shortness of breath. The nurse asks the patient about their medical history and notes they have a history of heart failure. The nurse determines that the cough and shortness of breath are likely related to heart failure exacerbation. What cognitive skill of the CJMM is the nurse exhibiting in this situation?
    a. recognize cues
    b. analyze cues
    c. prioritize hypotheses
    d. take action

3. Which situation best reflects the nursing student prioritizing hypotheses?
   a. The student measures a patient's blood pressure.
   b. The student checks the patient's chart to look at laboratory test results.
   c. The student determines that the patient's wound is infected and needs intervention.
   d. The student performs skin care on the patient's open wound.

4. The nursing student is working within an interdisciplinary care team to establish care goals for a patient. The student is actively engaging in what part of the CJMM?
   a. recognize cues
   b. analyze cues
   c. generate solutions
   d. evaluate outcomes

5. What individual factor should the nurse consider when making clinical judgment calls in practice?
   a. care setting
   b. resource availability
   c. cultural preferences
   d. nurse skill level

6. The student nurse is caring for a patient and, realizing they are unsure about how to perform a skill, they ask the supervising nurse for help. What attitude is the student exhibiting?
   a. independence of thought
   b. intellectual humility
   c. perseverance
   d. sociocentricity

7. What would a nursing student exhibiting egocentricity in practice be doing?
   a. The student nurse takes a lunch break before giving a patient pain medication.
   b. The student nurse provides care for a patient who has religious beliefs different from the student's own.
   c. The student nurse asks the supervising nurse why certain medications are being given.
   d. The student nurse realizes they are unsure about how to turn a patient in bed and asks for help.

8. The nurse assesses a patient and notes that they are clammy and fatigued. On the basis of the patient's history, the nurse determines the patient is experiencing a hypoglycemic emergency. What kind of reasoning did the nurse use to come to this conclusion?
   a. deductive reasoning
   b. inductive reasoning
   c. reductive reasoning
   d. productive reasoning

9. The nurse suspects a patient's cough is related to their underlying heart failure. What term describes the nurse's conclusion?
   a. generalization
   b. inductive reasoning
   c. hypothesis
   d. recognizing cues

10. What action represents an intellectual skill included in the 4-Circle CT Model?
   a. The nurse can place a peripheral intravenous catheter.
   b. The nurse recognizes there is missing information and obtains more data.
   c. The nurse describes various nursing models and theories.
   d. The nurse addresses a workplace conflict fairly.

Check Your Understanding Questions

1. What is the difference between the ADPIE nursing process and the CJMM?
2. What are some of the most important attitudes for a nurse to possess to be a good critical thinker?

Reflection Questions

1. Why do you think it was important for the CJMM to be developed?
2. Why do you think critical thinking is so important in nursing?
3. What do you think is the purpose of thinking in nursing?

Competency-Based Assessments

1. Write an example of a clinical story showing how a nurse effectively uses all parts of the CJMM to make a decision that positively influences a patient outcome.
2. In a small group, create a skit that represents one of the attitudes involved in critical thinking. Perform the skit for the rest of the class and have them guess which attitude the group is representing.

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APPENDIX A

Adult Lab Values

Note: These values could change slightly based on parameters set by specific healthcare facilities

Complete Blood Count (CBC)	
Red blood cell (RBC)	4.5 – 5.0 million cells/mm^3 (female) 4.7 – 6.2 million cells/mm^3 (male)
White blood cell (WBC)	4,500 – 11,000 cells/mm^3
Hemoglobin	12 – 16 g/dL (female) 13 – 17 g/dL (male)
Hematocrit	35 – 47% (female) 42 – 53% (male)
Platelets	150,000 – 400,000/mm^3
Complete Metabolic Panel (CMP)	
Blood urea nitrogen (BUN)	6 – 24 mg/dL
Serum creatinine	0.6 – 1.2 mg/dL
Estimated glomerular filtration rate (eGFR)	> 60 mL/min/1.73m^2
Carbon dioxide	23 – 29 mmol/L
Glucose	65 – 110 mg/dL
Chloride	95 – 105 mEq/L
Potassium	3.5 – 5.2 mEq/L
Sodium	135 – 145 mEq/L
Calcium	8.3 – 10.2 md/dL
Phosphorus	3.0 – 4.5 mg/dL
Magnesium	1.3 – 2.1 mEq/L
Serum osmolality	285 – 295 mOsm/kg H_2O
Albumin	3.5 – 5.5 g/dL

TABLE A1 **Adult Lab Values**

Total protein	5.5 – 8.3 g/dL
Bilirubin	0.1 – 1.2 mg/dL
Liver function tests (LFTs)	
Aspartate aminotransferase (AST)	9 – 25 units/L (female) 10 – 40 units/L (male)
Alanine aminotransferase (ALT)	7 – 20 units/L (female) 10 – 55 units/L (male)
Arterial Blood Gas (ABG)	
pH	7.35 – 7.45
Partial pressure of oxygen (PaO_2)	80 – 100%
Partial pressure of carbon dioxide ($PaCO_2$)	35 – 45 mmHg
Bicarbonate (HCO_3)	22 – 26 mEq/L
Coagulation Labs	
International normalized ratio (INR)	0.8 – 1.2 2 – 3 is normal for patients on warfarin
Prothrombin time (PT)	11 – 13 seconds 1.5-2x longer if on anticoagulants
Partial thromboplastin time (PTT)	60 – 70 seconds 1.5 – 2x longer if on anticoagulants
Activated partial thromboplastin time (aPTT)	25 – 35 seconds 1.5 – 2x longer if on anticoagulants
Lipid Panel	
High density lipoprotein (HDL)	> 40 mg/d
Low density lipoprotein (LDL)	< 100 mg/d
Triglycerides	< 120 mg/d
Total cholesterol	< 170 mg/d
Hemoglobin A1C	
Normal	< 5.7%

TABLE A1 **Adult Lab Values**

Prediabetes	5.7 – 6.4%
Diabetes	> 6.5%

TABLE A1 Adult Lab Values

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ANSWER KEY

Chapter 3

Unfolding Case Study

1. One of the first major findings that is relevant in this case is the fact that this patient does not speak English. Proper communication is key to establishing rapport with patients and to providing a thorough nursing assessment. Patients who do not speak English should be provided with a trained medical interpreter or interpreting service to ensure that communication is clear. It is not appropriate for a young child to interpret for his mother, due to the mature and complicated medical content, medical terminology, and risk for inaccurate interpretation. Although nonverbal communication, hand gestures, and body language can be used during the assessment, an experienced healthcare interpreter will ensure that a thorough nursing assessment can be conducted. Other relevant findings include the abnormal elevated white blood cell (WBC) count, cough with expectoration, and fever, all of which are indicative of infection. The ear pain reported as an 8/10 is also concerning and warrants follow-up.
2. More information should be obtained about the patient's reported ear pain. The nurse should perform a focused pain assessment, determining if the pain is constant, what it feels like, and whether anything makes it better or worse. Additionally, the nurse should inquire about the cough. Specifically, the nurse should ask how long the patient has had the cough, if anything makes it better, and if she has ever had a similar symptom, such as during the two occasions when she had COVID-19. The nurse should also ask the patient if she has ever been diagnosed with or treated for hypertension as her blood pressure reading is slightly elevated at this visit.
3. Symptoms of pneumonia that the patient is exhibiting include cough with expectoration, tachycardia, lethargy, fever, and elevated WBC count. The earache may be related to pneumonia as it can sometimes spread to the ears, resulting in an otitis media infection, but it is not a common symptom associated with the condition. The negative COVID-19 test indicates that the patient does not have COVID-19, but it does not tell us anything about pneumonia. The blood pressure elevation may be occurring for several reasons including underlying hypertension or stress and is not specific to pneumonia.
4. The provider has ordered an x-ray, so the nurse should contact radiology to make sure that gets done in a timely manner. The nurse has applied supplemental oxygen, so it is important to re-evaluate the patient's oxygenation status and increase oxygen as needed. The nurse should maintain close proximity to the patient in case of respiratory distress or arrest and provide emotional support to both the patient and son.
5. The nurse should obtain a sputum sample and send it to the lab for testing. As tolerated, the nurse will start to back off the oxygen, closely monitoring to ensure the patient maintains adequate oxygenation status. The nurse (with help from the interpreter) will provide education to the patient about prescribed medications.
6. Because the patient does not speak English, the nurse will have to rely on the interpreter to ensure understanding of provided information. Health literacy, an individual's ability to obtain, understand, and apply basic health information and services to make informed health decisions, is important, especially for patients with language or other barriers. The nurse should collaborate with the interpreter to have the patient "teach back" the information to ensure understanding.

Chapter 4

Unfolding Case Study

1. The oxygen saturation of 89 percent and increasing shortness of breath are the most concerning findings at this time. The x-ray results are also significant, as they confirm the presence of pneumonia. The sputum culture results should be monitored closely because the pharmacological treatment will be tailored to the specific pathogen causing the infection. The priority action for the nurse is to prepare the patient for transfer to local hospital which includes clinic discharge instructions for the patient, transfer documentation for the emergency transport employees, and giving report to the admitting facility per telephone call.

2. c Rationale: The son's comment about suicide or wanting to die if his mother dies is a red flag and is a priority to address.
3. a Rationale: A possible airway obstruction from tongue and throat swelling is the priority concern because it could lead to respiratory distress and/or arrest. Rash, temperature, and oxygen saturation of 96 percent are not a priority concern at this time.
4. The nurse should recognize the severity of the situation and call for help. If possible, the nurse should call a rapid response or the equivalent to it since they are still in the clinic setting. The provider should be notified immediately so that they may address the underlying cause of the facial and tongue swelling and prevent further respiratory compromise.
5. a
6. After administering the IV Benadryl, the nurse should see a decrease in swelling of the face and tongue. The rash should subside as well, but the main focus should be on the swelling of the face as that can quickly become life threatening. A worsening condition would be characterized by a lack of improvement in the facial swelling, indicating the need for further intervention or possibly another dose of Benadryl. Additionally, the nurse should closely monitor the patient for any side effects of the medication, especially lethargy.

Chapter 5

Unfolding Case Study

1. A. Rationale: The patient appears to be stable currently. The nurse should recognize the need for an interpreter as the priority to improve communication because the patient does not speak English.
2. C. Rationale: Pain is whatever the patient says it is. In this case, it is likely that the patient's culture processes pain and the meaning of pain differently than what the nurse expects to see. In some cultures, it is common to remain stoic, regardless of how severe the pain is. This highlights the importance of obtaining a thorough history and assessment so that cues are not missed.
3. Health disparities are health outcomes that are worse in certain populations. The social determinants of health are external factors such as the neighborhood people live in or access to health care and have a direct impact on health disparities. In this particular case, the patient reports that income is inconsistent, likely classifying the patient as from a low socioeconomic status, which is a social determinant of health. Having a limited (or inconsistent) amount of income directly impacts the patient's ability to provide for her family and obtain healthcare services, both of which contribute to the development of health disparities.
4. First, the nurse should attempt to obtain more information about the patient's situation. This needs to be done with care as this can be sensitive to talk about. In this case, the nurse also needs to request assistance from the interpreter because the patient does not speak English. Once more information about the patient's finance and home situation obtained, the nurse can initiate appropriate referrals. Often this includes a referral to a social worker or counselor who can assist the patient in finding community and other resources to address economic or social needs.
5. First, the nurse will determine what the patient considers to be the problem and what they call it. In this case, the nurse may ask the patient, "What do you call your illness?" or "What does your illness mean to you?" Second, the nurse should ask the patient what they think caused the illness. In some cultures, it is believed that illness is caused by imbalances in the body or is a punishment from God. The nurse should accept the patient's answer without judgment, even if it does not align with the nurse's personal beliefs. Next, the nurse should ask what the patient is doing to cope with the problem. The nurse should take note of any cultural differences in the way the patient handles the illness, such as use of folk remedies or nontraditional healers, which could impact the patient's care plan. Last, the nurse will ask the patient how concerned they are about the illness. Some cultures view illness as "God's will" and are not concerned, while others express more concern. In this case, specifically, the nurse may also want to ask how concerned the patient is about their finances and access to health care as it has been determined that the SDOH are likely impacting the patient's overall health.
6. Many times, nurses provide patients with resources and referrals while in the hospital but then have no idea if they followed through and got the assistance they needed. To combat this, the nurse can do a few different things. First, the nurse should work closely with the social worker to ensure that appropriate resources are available and that the patient's contact information is provided and all follow-ups are scheduled. This helps

ensure that contact with the patient is not lost after discharge. Additionally, the nurse should continuously assess the patient's social needs while they are in the hospital, initiating appropriate referrals as needed. In many cases, nurses and patients build a rapport during the hospital stay which allows the patient to confide in the nurse and allows the nurse to assist the patient with resources. The nurse can ask the patient questions such as "Did I address all of your concerns?" or "Is there anything you are worried about that we haven't talked about yet?" to determine whether the patient's social needs have been completely addressed.

Chapter 7

Unfolding Case Study

1. The patient's daughter expressed concern about her father not being asked about going to the bathroom and being left in soiled undergarments. Based on these concerns, the nurse would first want to perform a physical assessment on the patient with special focus on the perineal area. The nurse should assess the skin of the perineal area, noting any areas of redness or breakdown. Additionally, the nurse should assess the patient's mobility to gather information about whether the patient can safely ambulate to the bathroom alone or if assistance from care staff is required.
2. During the skin assessment, any areas of redness or breakdown in the perineal area would require immediate intervention by the nurse. This area of the body is prone to breakdown and subsequent infection if not kept clean and dry. These infections can quickly become severe and result in significant problems for the patient as they are hard to heal effectively once they occur. During the mobility assessment, if the nurse determines that the patient requires assistance getting to the bathroom, intervention by the nurse would be indicated.
3. There are several factors that could be contributing to the patient's current condition. First, the patient likely has limited mobility, making it difficult for him to ambulate to the bathroom without help. There may also be a lack of nursing staff, making it challenging to find someone to help him to the bathroom. In some cases, patients are also embarrassed to ask for help, so this may be a contributing factor. Regardless of contributing factors, it is imperative that the nurse begin to think about solutions to improve the patient's condition and prevent further tissue damage and decrease risk of infection.
4. Asking the nursing assistant to evaluate and document a patient's response to hygiene care is appropriate if the patient is alert and oriented. If the patient was not alert or oriented, this would be inappropriate. Asking the nursing assistant to provide perineal care for an unstable patient is not appropriate because this task is not in their scope of practice. They can only provide hygiene care for stable patients. The unit secretary should not be asked to help with the care as this is not in their scope of practice. The nursing assistant should not be asked to administer pain medications as this is not in their scope of practice. The nursing assistant can let the nurse know if the patient requested medication, but they cannot be the ones to administer it.
5. It's important to remember that family members of patients often need nursing support too. The daughter is clearly experiencing guilt for not being there for her father. One of the first things the nurse could do is reassure the daughter that her father is being taken care of. Let her know that her concerns are valid and are being addressed. It would also be helpful for the nurse to give the daughter more information about how her concerns are being addressed. For example, the nurse might let her know that her father will be asked every two hours if he needs to use the bathroom. During this interaction, it is important for the nurse to be kind and respectful of the daughter's feelings.
6. Outcomes that would indicate these interventions were successful include no perineal skin breakdown, no evidence of urinary tract infection, and maintenance of clean and dry undergarments. Additionally, the nurse would expect to observe patient and family satisfaction with new care plan.

Chapter 9

Unfolding Case Study

1. The patient reports having a difficult time walking to the bathroom, even going so far as to request placement of a catheter. Several parts of the musculoskeletal system are also concerning with relation to overall functional status. These findings include bilateral hip pain, back kyphosis, shuffling gait, and impaired leg muscle strength.
2. Internal factors that can affect mobility status include chronic disease, congenital abnormalities, fatigue, and

stress. This patient has an extensive medical history including COPD and heart attack, both of which could be contributing to progressive weakness and impaired mobility. It would be important for the nurse to ask the patient more about these conditions, such as if the patient has any shortness of breath with ambulation related to the COPD. The nurse should also inquire about the patient's stress level and sleep schedule. The patient is new to the nursing home, so it is likely that his normal routine has been altered. The patient may not be sleeping as well in the new setting or may be experiencing increased stress from the move. Both factors can affect overall mobility. In addition to internal factors, the nurse should evaluate external factors that could be impacting his mobility status. Specifically, the nurse should evaluate the patient's living conditions to see if they are conducive to ambulation. If the room is cluttered or difficult to navigate, the patient may be unwilling or unable to ambulate, even with help. In this case specifically, the patient's daughter has expressed concern about her father being left wet and soiled, indicating that maybe the facility is short staffed, which could also impact the patient's overall functional status and mobility.

3. Based on the information provided in the case study, the main priority for the patient at this time is improving mobility. The patient is experiencing lower extremity weakness and hip pain, both of which are hindering his ability to ambulate. If this does not improve, the patient will likely experience complications related to immobility such as skin breakdown, atelectasis, venous thrombosis, and depression. Additionally, the patient needs education about the importance of maintaining as much mobility as possible as he has shown resistance to moving by requesting placement of a catheter.
4. There are several strategies the nurse could use to improve the patient's mobility. First, the nurse should collaborate with the physical/occupational therapy team to create a plan of action that is appropriate for the patient's status and goals. The nurse should encourage the patient to move as they are able and assist them with active and passive range-of-motion exercises frequently. When the patient is in bed for longer periods of time, the nurse should ensure proper positioning and reposition the patient frequently to prevent complications of immobility. Additionally, the nurse may consider implementing the use of assistive devices to improve the patient's ability to move and ambulate.
5. B. Rationale: A gait belt is used to help unsteady patients with ambulation. This is appropriate for this patient as he reports having hip pain that makes it difficult to walk to the bathroom. The gait belt will allow him to still walk on his own but also provides additional assistance from the nurse and decreases the risk of the patient falling. Crutches are used for patients who cannot support the weight of one leg, usually from an acute injury, which is not the case for this patient. Canes are used for balance issues or compensation from an injury or disability, so this is not the most appropriate option for this patient. The sling transfer is used for patients who cannot walk at all. In this case, the patient can walk some, just not completely unassisted. A sling transfer would take away from the patient's independence, further limiting his mobility and functional status.
6. The gait belt should fit around the patient snugly, but the patient should not report any associated pain. Additionally, there should be no redness or skin breakdown underneath the area where the gait belt is placed. The patient should be able to comfortably ambulate to the bathroom and back while the nurse holds onto the gait belt. The patient should be able to explain the purpose of the gait belt and express acceptance with using it for ambulation assistance.

Chapter 15

Unfolding Case Study

1. The patient's chief complaint about shortness of breath and feeling "off" are important cues to notice since this is what brought them to the hospital for care. Additionally, another important cue to recognize is the patient's past medical history, which may be relevant to their symptoms. Noticing that the patient is anxious and leaning forward is another important cue to recognize because it is consistent with the patient's chief complaint.
2. Though the patient is reported as being alert and oriented ×4, the nurse should still perform a GCS assessment to have a tangible baseline for the patient's level of consciousness. This can be documented and checked periodically to watch for subtle changes in the patient's neurological status. The nurse should also take note of the patient's mobility and functional status during the general survey, such as noticing if they require assistive devices or have a limited range of motion. It would also be important for the nurse to assess how the patient is dressed, if they are height/weight proportional, and if they are well groomed. Assessing

these characteristics can present additional pieces of information that can be used to help effectively treat and care for the patient.

3. The nurse might expect to see a low oxygen saturation related to the crackles in the lungs and shortness of breath, both of which occur from heart failure due to a backup of blood into the lungs. The nurse would also expect the patient to exhibit tachycardia as they are anxious, and the heart is trying to compensate for the heart failure exacerbation.
4. The nurse should palpate the radial pulse, as it is usually the easiest one to find and feel. Because the patient may be experiencing heart failure exacerbation, the nurse may also want to auscultate the apical pulse of the heart to listen for associated abnormalities such as a murmur. The nurse may anticipate that the patient's pulse will be fast (tachycardia) and weak, because the heart is working overtime to compensate for the organ failure, and the patient is experiencing anxiety.
5. The most concerning vital signs are the oxygen saturation and respiratory rate. Airway and breathing are always the top priority, so the nurse should implement interventions to address those issues first. To start, the nurse should probably retake the vitals and double-check that the pulse oximeter is working correctly and that the patient is not wearing fingernail polish, as this can skew the readings. If those numbers are accurate, the nurse should contact the treating provider right away and report the findings. It is likely that the provider will order supplemental oxygen to improve the oxygen saturation level and maybe antianxiety medication to slow the patient's breathing rate.
6. First, the nurse would expect to see an increase in oxygen saturation. This patient does have COPD, so their baseline oxygen saturation may be high 80s or low 90s, but it should be improved from the initial 82 percent. The nurse would also expect to see a slowed respiratory rate (12 to 20 breaths per minute) and a normal respiratory pattern if the supplemental oxygen application was effective.

Chapter 17

Unfolding Case Study

1. Using an online calculator, a height of 5 feet, 5 inches and a weight of 221 pounds for a female is a BMI of 36.8.
2. The patient's BMI indicates they have obesity, which is clinically significant. Being overweight poses many risks to health, so this is something that the nurse should address at the appropriate time during the patient's hospitalization.
3. Based on the information provided in the case study, finances may be a contributing factor. The patient reports that it is hard to eat healthy because it is expensive, indicating that her economic status affects her weight. Other contributing factors may include sociocultural or lifestyle behaviors that result in overeating or unhealthy eating habits. Additionally, the patient may not have easy access to healthy foods, making it even more difficult to eat foods that promote a healthy body weight. The patient may also be experiencing mental health disorders or body image issues that could be contributing to her weight gain. The nurse should investigate these potential factors further to better understand the patient's specific situation.
4. First, the nurse should gather more information about factors contributing to her obesity. With this information, it will be easier for the nurse to understand the patient's situation and provide patient-centered interventions and care. Next, the nurse should gauge the patient's willingness to make dietary and lifestyle changes to support a healthier body weight. If the patient is unable or unwilling to make changes, the nurse must respect that and provide them with resources for when they are ready.
5. Based on the patient's specific situation, the nurse should include teaching about limiting eating out when possible. Restaurant food is notorious for being high in sodium, which should be avoided by patients with hypertension. The nurse should also provide more generic information about the principles of healthy eating including eating a large variety of foods, choosing healthy proteins, drinking lots of water, limiting salt and alcohol intake, and avoiding processed foods.
6. After educating the patient about healthy eating, the nurse should assess the patient's understanding by having them "teach back" the information. Additionally, the nurse could have the patient list some healthy alternatives to eating out that the patient is willing to try.

Chapter 18

Unfolding Case Study

1. There are several cues that should be concerning to the nurse. First, thinking about the ABC priorities, the nurse should notice that the patient is experiencing dyspnea on exertion and labored breathing with an oxygen saturation of less than 90 percent. Additionally, the nurse hears crackles in the bases of the lungs, which is likely contributing to the patient's poor respiratory status. Other cues to recognize include the presence of jugular venous distension, sinus tachycardia, and peripheral pitting edema of the lower extremities.
2. Jugular venous distension, lower extremity edema, and a BP of 145/82 are indicative of hypertension. Jugular venous distension, lower extremity edema, tachycardia, crackles in the lungs, and dyspnea are all consistent with a HF exacerbation. An O_2 saturation of less than 90 percent, crackles in lungs, and dyspnea on exertion are consistent with COPD. It is important for the nurse to be able to not only recognize cues but also determine which cues are consistent with the patient's clinical presentation and past medical history.
3. The most likely cause of the patient's symptoms is HF. The patient has a history of HF, and the current symptoms are indicative of an acute exacerbation of the condition.
4. The supplemental oxygen is ordered to improve the patient's oxygen saturation level. This will help with tissue perfusion and hopefully improve the patient's dyspnea and tachypnea. The rationale for the IV insertion is so that the nurse will be able to administer medications more quickly. This is especially important for patients exhibiting respiratory and cardiac issues as these can quickly become life threatening. The furosemide (Lasix) is ordered to rid the body of excess fluid, which will hopefully improve the crackles in the lungs and dyspnea as well as decrease the peripheral lower extremity edema. Intake and output monitoring and documentation are ordered because the patient is exhibiting signs of fluid overload and is being given a diuretic. Both situations can cause fluid imbalances, so it is important to monitor overall fluid status carefully and intervene as needed.
5. The priority action by the nurse would be to administer supplemental oxygen because the patient's oxygen saturation is low. Thinking back to the ABCs of nursing care, airway and breathing always come first. Next, the nurse would want to establish the IV and administer the diuretic to rid the lungs of excess fluid, further improving overall oxygenation status.
6. The nurse would expect to see an increase in the patient's oxygenation saturation and improvement in their breathing pattern. If the medication is working effectively, the nurse should hear less crackles in the lungs, see improvement in the peripheral edema, and notice that the patient is urinating more frequently or voiding larger amounts.

Chapter 19

Unfolding Case Study

1. Findings from this case study that may indicate a fluid imbalance include elevated blood pressure, elevated heart rate, pitting edema in the lower extremities, crackles in lungs, and dyspnea.
2. Based on the findings listed in question 1, it is likely the patient is experiencing FVE. The extra fluid is accumulating in the lungs and interstitial spaces, leading to crackles in the lungs and peripheral edema, respectively. Additionally, with more fluid circulating in the body, the patient is likely to experience increased blood pressure and elevated heart rate as the body attempts to pump the extra blood through the body.
3. The patient is experiencing fluid excess, which results in an increased cardiac output. The formula for cardiac output (CO) is CO = SV × HR, where SV = stroke volume and HR = heart rate. We know the patient has an elevated heart rate (tachycardia) and an increased stroke volume (from high blood pressure and fluid excess), so if you plug that information into the formula, you get an elevated cardiac output. This can be a good compensatory mechanism for the body at first, but eventually the heart will tire out, resulting in inadequate cardiac output. Additionally, the patient is experiencing an increase in preload, or the amount of blood being brought to the heart.
4. Because the patient is experiencing fluid excess, the diuretic is ordered to rid the body of some of the extra fluid. This will decrease the preload, thus decreasing the amount of blood being brought back to the heart. This decreases the workload of the heart and, hopefully, also will improve the patient's respiratory status.

5. The nurse should monitor serum sodium, chloride, and potassium levels closely as administration of diuretics may increase their excretion from the body. Rapid shifts in any of these electrolytes can have life-threatening effects, so it is imperative that the nurse monitor these values daily, or more frequently, as ordered by the treating clinician.
6. The nurse would expect to see an increase in urination after administration of the furosemide. With that, the nurse would also expect to see a decrease in blood pressure, improvement in lung sounds and oxygenation status, and less peripheral edema. The nurse would also expect to see some daily weight loss that corresponds to the amount of fluid being excreted as urine, if the interventions were successful.

Chapter 24

Unfolding Case Study

1. The 7/10 chest pain is the finding of most concern because this is a new symptom and may indicate an acute problem. It is also important to recognize that the patient is experiencing an abnormally fast heart rate with PVCs, which can indicate an underlying cardiac issue. The elevated respiratory rate is also a concern because this may indicate issues with the lungs. The high blood pressure is a concern but not the priority at this time.
2. Based on the recognized cues, it is likely that the patient is experiencing a cardiac issue. Specifically, the patient may be experiencing a myocardial infarction or a continued severe exacerbation of heart failure.
3. The nurse should anticipate performing diagnostic tests to rule out cardiac disorders. These include a 12-lead ECG and blood tests. Eventually the provider may also order a stress test or cardiac catheterization.
4. An elevated troponin level is indicative of myocardial damage or ischemia, often related to a myocardial infarction, or heart attack. The nurse should first alert the treating provider about the elevated troponin if they are unaware. Next, the nurse should monitor the patient closely and prepare to take the patient to the cardiac catheterization laboratory for further investigation and possible intervention.
5. The nurse should explain that the patient will be given medication to help her sleep while dye is injected into their vessels. The dye helps to visualize the vessels that lead to the heart to determine if there are any blockages present. If blockages are present, the provider can perform an intervention such as placing a stent to keep the vessel open. This will help restore blood flow to the heart and keep the heart muscle from being damaged.
6. First and foremost, the patient should not be experiencing chest pain after the procedure. Additionally, the cardiac monitor should show a normal rhythm. Troponin levels should be trending downward and the patient should report less dyspnea.

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"butterfly" cannula 517

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