

Clara is a 77-year-old female who is admitted to an inpatient acute care center for scheduled hip-replacement surgery. See Figure 6.13 for an image of Clara.¹ On admission for the surgical procedure, Clara is functionally independent and living at home but reports having some “mild forgetfulness.” The surgery and post-anesthesia recovery period are uneventful, but on postoperative Day 2, she develops severe confusion and agitation.

Critical Thinking Questions

1. What additional assessment data should the nurse collect?
2. Compare/contrast the symptoms of dementia, delirium, and depression. What condition is the client exhibiting? What are the possible triggers?
3. What are priority nursing interventions for the client at this time?

Scenario B



Figure 6.14 Simulated Client Image

Betty is an 82-year-old female resident of a memory care center with a history of moderate Alzheimer’s disease. See Figure 6.14 for

1. “[woman-76527_960_720.jpg](#)” by [geralt](#) is licensed under [CC0](#)

an image of Betty in a memory care center.² Staff report that she has episodes of anxiety and agitation that can lead to aggressive behaviors such as yelling, cursing, and waving her cane threateningly at staff members.

Critical Thinking Questions

1. What are the typical symptoms of moderate Alzheimer's disease?
2. What assessments should the nurse perform if Betty exhibits anxiety, agitation, or aggressive behavior?
3. In addition to identifying and eliminating any potential triggers, how should the nurse respond to Betty therapeutically if an episode occurs?
4. What types of medications may be prescribed for Betty to slow the progression of Alzheimer's disease?



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=1950#h5p-63>



2. "[35528913166_1a61470157_h.jpg](#)" by [Senior Guidance](#) is licensed under [CC BY 2.0](#)

- ▶ Test your knowledge using this [NCLEX Next Generation-style question](#). You may reset and resubmit your answers to this question an unlimited number of times.³

3. “Chapter 6 Assignment 1” by Tami Davis for [OpenRN](#) is licensed under [CC BY-NC 4.0](#)

VI Glossary

OPEN RESOURCES FOR NURSING (OPEN RN)

Adult day care centers: Care that offers people with dementia and other chronic illnesses the opportunity to be social and to participate in activities in a safe environment, while also giving their caregivers the opportunity to work, run errands, or take a much-needed break. ([Chapter 6.3](#))

Ageism: The stereotyping and discrimination against individuals or groups on the basis of their age. Ageism can take many forms, including prejudicial attitudes, discriminatory practices, or institutional policies and practices that perpetuate stereotypical beliefs. ([Chapter 6.4](#))

Alzheimer's disease: An irreversible, progressive brain disorder that slowly destroys memory and thinking skills and eventually the ability to carry out the simplest tasks. ([Chapter 6.3](#))

Cognition: A term used to describe our ability to think. ([Chapter 6.1](#))

Cognitive impairment: Impairment in mental processes that drive how an individual understands and acts in the world, affecting the acquisition of information and knowledge. ([Chapter 6.2](#))

Delirium: An acute state of cognitive impairment that typically occurs suddenly due to a physiological cause, such as infection, hypoxia, electrolyte imbalances, drug effects, or other acute brain injury. ([Chapter 6.2](#))

Dementia: A chronic condition of impaired cognition, caused by brain disease or injury, marked by personality changes, memory deficits, and impaired reasoning. Dementia can be caused by a group of conditions, such as Alzheimer's disease, vascular dementia, frontal-temporal dementia, and Lewy body disease. It is gradual, progressive, and irreversible. ([Chapter 6.2](#))

Depression: A brain disorder that can cause a persistent low mood, memory problems, loss of interest in life, and other symptoms that can overlap with dementia. ([Chapter 6.2](#))

Development: Biological changes, as well as social and cognitive changes, that occur continuously throughout our lives. ([Chapter 6.2](#))

Growth: Physical changes that occur during the development of an individual beginning at the time of conception. ([Chapter 6.2](#))

Hospice care: A type of care selected by clients who are terminally ill and whose health care provider has determined they are expected to live six months or less that focuses on providing comfort and dignity at the end of life. It involves care and support services that can be of great benefit to people in the final stages of dementia and to their families. ([Chapter 6.3](#))

Intellectual disability: A diagnostic term that describes intellectual and adaptive functioning deficits identified during the developmental period prior to the age 18. ([Chapter 6.2](#))

Respite care: Care provided at home (by a volunteer or paid service) or in a care setting, such as adult day centers or residential facilities, that allows the caregiver to take a much-needed break. ([Chapter 6.3](#))

Sundowning: Increased confusion, anxiety, agitation, pacing, or disorientation in clients with dementia that typically begins at dusk and continues throughout the night. ([Chapter 6.3](#))

PART VII

SENSORY IMPAIRMENTS

7.1 Sensory Impairments

Introduction

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Learning Objectives

- Identify risk factors for sensory impairments
- Identify cues related to sensory impairments across the life span
- Identify interventions to support diverse clients (individual, family, or group) with sensory impairments
- Contribute to a plan of care for clients with sensory impairments
- Detail support for family/significant others caring for clients with a sensory impairment
- Include community resources available for clients and families with a sensory impairment
- Include adaptations to the environment to maintain safety for the client with a sensory impairment
- Outline evidence-based nursing interventions for specific sensory disorders

Our five basic senses of sight (vision), hearing (auditory), touch (tactile), smell

(olfactory), and taste (gustatory) help us perceive and act in the world around us. See Figure 7.1¹ for an illustration of our five senses.



Figure 7.1 Five Senses

We may not often consider the importance of our sensory input. As nurses, we especially rely on our senses when providing client care as we gather assessment data. We ask questions and listen to client responses, we listen to their heart and lung sounds, we evaluate the appearance of their skin, we may smell an infectious process when changing a wound dressing, and we feel the sensation of pulses when assessing circulation.

When an individual experiences sensory impairment because of the loss of one or more senses or is affected by the amount of stimuli (too much or too little), their ability to safely function is impacted. Nurses identify clients' sensory impairments and implement interventions to improve their safety, functioning, and quality of life. The nurse's goal is to provide support and dignity to individuals and their families by using strategies and resources that

1. "[Five_senses.jpg](#)" by Allan-Hermann Pool is licensed under [CC BY-SA 4.0](#)

will help them to engage with their surroundings and others to the best of their ability.

This chapter will review common sensory impairments and related nursing care.

7.2 Sensory Impairments

Basic Concepts

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Interpreting Sensations

Before learning about sensory function, it is important to understand how the nervous system works. An intact nervous system is necessary for information to be delivered from the environment to the brain to trigger responses from the body. For neurons to transmit these messages, they are in the form of an action potential. Sensory receptors perceive a stimulus and then change the sensation to an electrical signal so that it can be transmitted to the brain and then out to the body. For example, a pain receptor perceives pain as your hand touches a hot tray. The signal is transmitted to the brain where it is interpreted, and then signals are quickly sent to the hand to pull away from the hot stimuli.¹

Our bodies interpret sensations through a process using reception, perception, and reaction. **Reception** is the first part of the sensory process when a nerve cell or sensory receptor is stimulated by a sensation. Sensory receptors are activated by mechanical, chemical, or temperature stimuli. In addition to our five senses, we also have somatosensation. **Somatosensation** refers to sensory receptors that respond to stimuli such as pain, pressure, temperature, and vibration. It also includes **vestibular sensation**, a sense of spatial orientation and balance, and **proprioception**, the sense of the position of our bones, joints, and muscles. Although these sensory systems are all very

1. Gadhvi, M. (2023). *Physiology, sensory system*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK547656/>

different, they share a common purpose. They change a stimulus into an electrical signal that is transmitted in the nervous system.²

The sensory receptors for each of our senses work differently from one another. Light receptors, sound receptors, and touch receptors are each activated by different stimuli with specialized receptor specificity. For example, touch receptors are sensitive to pressure but do not have sensitivity to sound or light. Nerve impulses from sensory receptors travel along pathways to the spinal cord or directly to the brain. Some stimuli are also combined in the brain, such as our sense of smell that can affect our sense of taste.³

As an individual becomes aware of a stimulus and it is transmitted to the brain, perception occurs. **Perception** is the interpretation of a sensation. All sensory signals, except olfactory system input, are transmitted to the thalamus and to the appropriate region of the cortex of the brain. The thalamus, which is in the forebrain, acts as a relay station for sensory and motor signals. When a sensory signal leaves the thalamus, it is sent to the specific area of the cortex that processes that sense.⁴ However, conditions that affect a person's consciousness also affect the ability to perceive and interpret stimuli.

Reaction is the response that individuals have to a perception of a received stimulus. The brain determines what sensations are significant because it is impossible to react to all stimuli that are constantly received from our

2. Learneo, Inc. (n.d.). *Sensory processes*. nursinghero.

<https://www.nursinghero.com/study-guides/boundless-biology/sensory-processes>

3. Learneo, Inc. (n.d.). *Sensory processes*. nursinghero.

<https://www.nursinghero.com/study-guides/boundless-biology/sensory-processes>

4. Learneo, Inc. (n.d.). *Sensory processes*. nursinghero.

<https://www.nursinghero.com/study-guides/boundless-biology/sensory-processes>

environment. A healthy brain maintains a balance between sensory stimuli received and those reaching awareness. However, sensory overload can occur if the amount of stimuli the brain is receiving is overwhelming to an individual. Sensory deprivation can also occur if there are insufficient sensations from the environment.⁵

Sensory Impairment

Alterations in sensory function include sensory impairment, sensory overload, and sensory deprivation. **Sensory impairment** includes any type of difficulty that an individual has with one of their five senses. When an individual experiences loss of a sensory function, such as vision, the way they interact with the environment is affected. For example, when an individual gradually loses their vision, their reliance on other senses to receive information from the environment is often enhanced.

Safety is always a nursing consideration for a client with a sensory impairment. Intact senses are required to make decisions about functioning safely within the environment. For example, an individual who has impaired hearing may not be able to hear a smoke alarm and requires visual indicators when the alarm is triggered.

Sensory impairments are very common in older adults. Most older adults develop impaired near vision called presbyopia, resulting in the need for reading glasses. See Figure 7.2⁶ for an image of simulated presbyopia.

Deficits in taste and smell are also prevalent in this age group. Additionally, **kinesthetic impairment** (an altered sense of touch) can occur in adults as young as 55. Kinesthetic impairment can cause difficulty in daily functioning,

5. Learneo, Inc. (n.d.). *Sensory processes*. nursinghero.

<https://www.nursinghero.com/study-guides/boundless-biology/sensory-processes>

6. "[Pesto ingredients – blurred.jpg](#)" by Colin is licensed under [CC BY-SA 4.0](#)

such as buttoning one's shirt or performing other fine motor tasks. These sensory losses can greatly impact how older adults live and function.⁷



Figure 7.2 Simulated Impaired Vision Due to Presbyopia

Vision Impairments

Several types of visual impairments commonly occur in older adults, including macular degeneration, cataracts, glaucoma, diabetic retinopathy, and presbyopia. See Table 7.2 for more information about each of these visual conditions.

Table 7.2 Common Visual Conditions

7. Correia, C., Lopez, K. J., Wroblewski, K. E., Huisingh-Scheetz, M., Kern, D. W., Chen, R. C., Schumm, L. P., Dale, W., McClintock, M. K., & Pinto, J. M. (2016). Global sensory impairment in older adults in the United States. *Journal of the American Geriatrics Society*, 64(2), 306–313. <https://doi.org/10.1111/jgs.13955>

Macular Degeneration	Macular degeneration is the leading cause of legal blindness in individuals over 60 years of age. Risk factors include advancing age, a positive family history, hypertension, and smoking. In macular degeneration, there is loss of central vision with classic symptoms such as blurred central vision, distorted vision that causes difficulty driving and reading, and the requirement for brighter lights and magnification for close-up visual activities. ⁸
Cataracts	Cataracts are the opacity of the lens of the eye that causes clouded, blurred, or dimmed vision. About half of individuals ages 65 to 75 will develop cataracts, with further incidence occurring after age 75. Cataracts can be removed with surgery that replaces the lens with an artificial lens. ⁹
Glaucoma	Glaucoma is caused by elevated intraocular pressure that leads to progressive damage to the optic nerve, resulting in gradual loss of peripheral vision. It affects about 4% of individuals over age 70. ¹⁰
Diabetic Retinopathy	Diabetic retinopathy is the leading cause of blindness in adults diagnosed with type 1 and type 2 diabetes mellitus. Diabetic retinopathy is a complication of diabetes mellitus due to damaged blood vessels in the retina causing vision loss. ¹¹ Clients with diabetes are encouraged to receive annual eye exams so that retinopathy can be discovered and treated early. Treatments, such as laser treatment that can help shrink blood vessels, injections that can reduce swelling, or surgery, can prevent permanent vision loss. ¹²
Presbyopia	As a person ages, the lens of the eye gradually becomes thicker and loses flexibility. It stops focusing light on the retina correctly, causing impaired near vision and accommodation at all distances. Presbyopia starts in the early to mid-forties and worsens with aging. It can lead to significant visual impairment but does not usually cause blindness. ¹³

8. Loh, K. Y., & Ogle, J. (2004). Age related visual impairment in the elderly. *The Medical Journal of Malaysia*, 59(4), 562–569. <https://pubmed.ncbi.nlm.nih.gov/15779599/>

9. Loh, K. Y., & Ogle, J. (2004). Age related visual impairment in the elderly. *The Medical Journal of Malaysia*, 59(4), 562–569. <https://pubmed.ncbi.nlm.nih.gov/15779599/>

10. Loh, K. Y., & Ogle, J. (2004). Age related visual impairment in the elderly. *The Medical Journal of Malaysia*, 59(4), 562–569. <https://pubmed.ncbi.nlm.nih.gov/15779599/>

11. Loh, K. Y., & Ogle, J. (2004). Age related visual impairment in the elderly. *The Medical Journal of Malaysia*, 59(4), 562–569. <https://pubmed.ncbi.nlm.nih.gov/15779599/>

▶ See simulated images of these visual conditions in the “[Eye and Ear Basic Concepts](#)” section of the “Eye and Ear Assessment” chapter of the Open RN *Nursing Skills, 2e* book.

Hearing Loss and Ear Problems

Approximately one third of individuals aged 70 and older have hearing loss. Good hearing depends on a series of events that change sound waves in the air into electrical signals. The auditory nerve conducts these electrical signals from the ear to the brain through a series of steps. The structures of the ear, such as the tympanic membrane and cochlea, must be intact and functioning appropriately for conduction of sound to occur. Age-related hearing loss (**presbycusis**) gradually occurs in most individuals as they age.¹⁴ Typically, low-pitched sounds are easiest to hear, but it often becomes increasingly difficult to hear normal conversation, especially over loud background noise. Hearing aids are commonly used to enhance hearing. See Figure 7.3¹⁵ for an image of common hearing aids used to treat hearing loss.

12. Centers for Disease Control and Prevention. (2024). *Vision loss and diabetes*. <https://www.cdc.gov/diabetes/diabetes-complications/diabetes-and-vision-loss.html>
13. Loh, K. Y., & Ogle, J. (2004). Age related visual impairment in the elderly. *The Medical Journal of Malaysia*, 59(4), 562–569. <https://pubmed.ncbi.nlm.nih.gov/15779599/>
14. National Institute on Deafness and Other Communication Disorders. (2024). *Age-related hearing loss (Presbycusis)*. <https://www.nidcd.nih.gov/health/age-related-hearing-loss>
15. “[Traditional_hearing_aids.jpg](#)” by ikesters is licensed under [CC BY-SA 2.0](#)



Figure 7.3 Common Hearing Aids

Hearing loss can be caused by other factors in addition to aging. A build-up of ear wax in the ear canal can cause temporary hearing loss. Sounds that are too loud or long-term exposure to loud noises can cause noise-induced hearing loss. For example, a loud explosion or employment using loud machinery without ear protection can damage the sensory hair cells in the ear. After these hair cells are damaged, the ability to hear is permanently diminished. **Tinnitus**, a medical term for ringing in the ears, can also occur. Some medications, such as high doses of aspirin or loop diuretics, can cause toxic effects to the sensory cells in the ear and lead to hearing loss or tinnitus.^{16 17} In addition to hearing loss, ear problems can also cause problems with balance, dizziness, and vertigo due to vestibular dysfunction.

Kinesthetic Impairments

Kinesthetic impairments, such as peripheral neuropathy, affect the ability to feel sensations. Symptoms of peripheral neuropathy include sensations of pain, burning, tingling, and numbness in the extremities that decrease a

16. National Institute on Deafness and Other Communication Disorders. (2024). *Age-related hearing loss*. <https://www.nidcd.nih.gov/health/age-related-hearing-loss>
17. American Speech-Language-Hearing Association. (n.d.). *Causes of hearing loss in adults*. <https://www.asha.org/public/hearing/causes-of-hearing-loss-in-adults/>

person's ability to feel touch, pressure, and vibration. Position sense can also be affected and makes it difficult to coordinate complex movements, such as walking, fastening buttons, or maintaining balance when one's eyes are closed. Peripheral neuropathy is caused by nerve damage that commonly occurs in clients with diabetes mellitus or peripheral vascular disease. It can also be caused by physical injuries, infections, autoimmune diseases, vitamin deficiencies, kidney diseases, liver diseases, and certain medications like chemotherapy medications.¹⁸

Life Span Considerations

Impaired sensory functioning increases the risk for social isolation in older adults. For example, when individuals are not able to hear well, they may pretend to hear in an attempt to avoid embarrassment when asking for the information to be repeated. They may begin to avoid noisy environments or stop participating socially in conversations around them.

Infants and children are also at risk for vision and hearing impairments related to genetic or prenatal conditions. Early determination of sensory impairments is crucial so that problems can be addressed with accommodations to minimize the impact on a child's development. For example, a screening hearing test is completed on all newborns before discharge to evaluate for hearing impairments that can affect their speech development.

Sensory Overload and Sensory Deprivation

Stimuli are continually received from a variety of sources in our environment and from within our bodies. When an individual receives too many stimuli or cannot selectively filter out meaningful stimuli, sensory overload can occur.

18. National Institute of Neurological Disorders and Stroke. (n.d.). *Peripheral neuropathy*. <https://www.ninds.nih.gov/health-information/disorders/peripheral-neuropathy>

Symptoms of **sensory overload** include irritability, restlessness, covering ears or eyes to shield them from sensory input, and increased sensitivity to tactile input (i.e., scratchy fabric or sensations of medical equipment).¹⁹ Sensory overload affects an individual's ability to interpret stimuli from their environment and can lead to confusion and agitation. See Figure 7.4²⁰ of an image of a client reacting to sensory overload.

The health care environment with its frequent noisy alarms, treatments, staff interruptions, and noisy hallway conversations can cause sensory overload for clients. Additionally, the amount of information provided to a client experiencing a health crisis can contribute to sensory overload, such as teaching about procedural and diagnostic testing. Clients may only be able to process small chunks of information provided at a time and may need this information repeated to ensure they understand their situation and retain the information.

Individuals have different tolerances for the amount of stimuli that will affect them adversely. Tolerance to stimuli is impacted by factors such as pain, stress levels, sleep patterns, physical health, and emotional health. When sensory overload occurs in a hospitalized client, it can lead to delirium and acute confusion. It is important for the nurse to limit unnecessary awakenings and interactions with the health care team members when a client is experiencing sensory overload.

19. Watson, K. (2018). *What is sensory overload?* Healthline.

<https://www.healthline.com/health/sensory-overload#causes>

20. "[Sensory Overload.jpg](#)" by [Stewart Black](#) is licensed under [CC BY 2.0](#)



Figure 7.4 Sensory Overload

Conversely, symptoms of **sensory deprivation** may occur when there is a lack of sensations due to sensory impairments or few quality stimuli in the client environment. This may include hearing or vision impairments, brain or spinal injuries resulting in lack of tactile sensations, having few or no visitors, or having transmission-based precautions resulting in decreased staff interaction. Interventions such as opening window curtains, providing a clock and calendar for orientation to the time and the day of the week, encouraging visitors, and spending additional time with the client can help prevent sensory deprivation.

Clients with sensory deprivation may experience excessive tiredness or lethargy, disorientation, depression or apathy. People experiencing sensory deprivation often report perceptual disturbances such as hallucinations. Symptoms of sensory deprivation can mimic delirium, so it is important for a nurse to further investigate new perceptual disturbances.²¹

21. Mason, O., & Brady, F. (2009). The psychotomimetic effects of short-term sensory deprivation. *The Journal of Nervous and Mental Disease, 197*(10), 783-785. <https://doi.org/10.1097/nmd.0b013e3181b9760b>

Review information on delirium in [“Basic Concepts”](#) section of the “Cognitive Impairments” chapter.

7.3 Applying the Nursing Process

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This section outlines the steps of the nursing process when providing care for individuals with altered sensory function in any setting.

Assessment

When assessing a client for sensory impairments, it is important to first establish a therapeutic relationship. Individuals may be hesitant to discuss sensory problems. By establishing a good rapport, clients are more likely to share their sensory concerns and effects on functioning. The health history should include questions regarding current status of sensory function, as well as risk for development of sensory impairment. For example, medications that can be ototoxic should be considered a risk factor for hearing impairment. Additionally, opioids and sedatives depress the central nervous system and can impair stimuli perception and reaction. Techniques to identify deficits in vision, hearing, smell, taste, and sensation are used during the physical exam. Read additional information about assessment techniques using information in the following box.

- ▶ Read about common disorders and how to assess the eyes and ears in the “[Eye and Ear Assessment](#)” chapter of the *Open RN Nursing Skills, 2e* textbook.
- ▶ Read more about assessing [sensory functioning](#) in the “Neurological Assessment” chapter of the *Open RN Nursing Skills, 2e* textbook.

There are several factors to consider when assessing a client's sensory functioning, such as age, their perception of the impairment, and the impact of the sensory impairment on their daily functioning. Age is an important consideration because many sensory functions can be affected by the aging process. However, it should not be assumed that all sensory problems are a normal part of the aging process. It is important to assess the client's perception of sensory impairment and its impact on their functioning, as well for any changes in recent behavior, mental status, emotional status, or cognitive function changes. For example, individuals experiencing hearing loss may be more irritable or anxious and avoid social gatherings due to their hearing impairment. If a client is experiencing confusion, it is important to evaluate underlying factors that can cause confusion, such as infection, delirium, or electrolyte imbalances.

The environment is also an important consideration when assessing an individual's sensory functioning. It is important to understand the client's daily activities and their ability to perform them; their work and living environment; their use of protective equipment, such as ear protection when working with loud equipment; and their adherence with routine screenings, such as vision and hearing exams. Individuals with sensory impairments are at increased risk for falls and injury, so it is important to encourage basic safety features in the environment, including adequate lighting, availability of handrails and grab bars, hazard-free walkways, and appropriate settings on water heater controls.

When sensory impairments are identified, they should be documented in the client's chart and communicated to collaborative team members working with the individual. For example, when an individual has a hearing impairment, it is important to consider their alternative communication needs. They may use lipreading and require face-to-face views when communicating. The use of assistive devices for sensory functioning, such as glasses and hearing aids, should also be documented and communicated. It is important to ensure proper functioning of the devices for optimal client outcomes. In fact, a hospitalized older adult is at greater risk for developing delirium when their typical glasses and hearing aids (i.e., their "eyes and ears") are not available because this contributes to sensory deprivation.

See Table 7.3a for a comparison of expected versus unexpected findings on assessment, including those that require notification of the health care provider.

Table 7.3a Expected Versus Unexpected Findings

Assessment	Expected Findings	Unexpected Findings
<p>Hearing and Ears: Assess ability to appropriately answer questions individually and in a group setting. Assess the ear canal for excess cerumen. Perform a whisper test while standing behind the seated client. Observe the client's balance and gait. Review how to perform the whisper test in Chapter 8.3 in <i>Open RN Nursing Skills, 2e</i>.</p>	<p>The patient can converse and answer questions. Presbycusis can occur with aging.</p>	<p>Inability to communicate; complaints of ringing in ears (tinnitus), decreased attention, and withdrawal from conversations. Poor coordination, loss of proprioception, increased falls. Report to the health care provider recent changes in hearing, new tinnitus, imbalance, or dizziness.</p>
<p>Vision: Assess near vision by the ability to read printed material. Use the Snellen chart to assess distant vision. In a long-term care or home setting, observe the client's ability to perform ADLs.</p>	<p>Presbyopia, the gradual loss of the ability to focus on nearby objects, may begin around age 40. Reading glasses may become necessary for close work.</p>	<p>Report to the health care provider new changes in vision.</p>
<p>Touch: Assess ability to feel stimuli by lightly touching the extremities, bottom of the feet, and fingers. Ask if the client has unusual sensations in their extremities (e.g., tingling, burning, pain).</p>	<p>The client can feel light touch and discriminate between warm and cold.</p>	<p>Inability to feel light touch; reported new numbness, tingling, or pain in the extremities. Report to the health care provider sudden changes in sensation or peripheral neuropathy or new onset of facial numbness (such as in the case of a cerebrovascular accident, commonly referred to as a stroke).</p>
<p>Smell: Assess ability to identify odors with eyes closed.</p>	<p>The client can identify smells such as vanilla, lemon, or coffee. The sense of smell often diminishes with advancing age.</p>	<p>Inability to differentiate odors or decreased sensitivity to strong odors.</p>

<p>Taste: Ask about food intake and taste.</p>	<p>The client can determine if food is salty, sweet, or spicy.</p>	<p>Inability to discriminate taste, leading to changes in appetite, weight loss, excess use of salt or sugar, and depression.</p>
<p>Sensory Input: Assess for cognitive, perceptual, and affective changes.</p>	<p>Sensory stimulation is adequate to maintain awareness.</p>	<p>Irritability, restlessness, covering ears or eyes to shield themselves from sensory input, increased sensitivity to tactile input. Reduced learning capacity or inability to think. Confusion, boredom, changes in visual/motor coordination. Report to health care provider sudden changes in cognitive, perceptual, or affective abilities.</p>

Diagnoses

Commonly used NANDA-I nursing diagnoses for clients experiencing alterations in sensory function include the following:¹

- *Risk for Injury*
- *Risk for Adult Falls*
- *Impaired Verbal Communication*
- *Social Isolation*

A common NANDA diagnosis related to sensory alterations is *Risk for Injury*, which is defined as, “Susceptible to physical damage due to environmental conditions interacting with the individual’s adaptive and defensive resources, which may compromise health.” “Alteration in sensation” is an associated

1. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.

condition for this nursing diagnosis. For risk diagnoses, there are no related factors (etiological factors) because you are identifying a vulnerability in a client for a potential problem that is not yet present. Additionally, the nurse cannot resolve sensory alteration, so it should not be listed as a related factor to which interventions are directed. Instead, the phrase “as evidenced by” is used to refer to the evidence of risk that exists.

Therefore, a sample NANDA-I diagnosis in current PES format would be as follows: *“Risk for Injury as evidenced by alteration in vision.”*

Outcomes

An overall goal for a client at risk for injury related to alteration in sensation is as follows:

- *The client will remain free from injury.*

An example of a “SMART” expected outcome for a client with impaired vision is as follows:

- *The client will be able to verbalize the layout of the room within four hours of admission.*

Planning Interventions

There are many nursing interventions that can be implemented for individuals with impaired sensory function. To assist clients to communicate effectively and to promote their quality of life, it is important for the nurse to customize appropriate interventions based on their individual needs. As always, refer to an evidence-based nursing care planning resource when customizing interventions for specific clients. See Table 7.3b for basic nursing interventions to implement for a variety of sensory alterations.²

2. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.

Table 7.3b Nursing Interventions to Address Sensory Alterations³

3. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.

Sensory Alteration	Nursing Interventions
Impaired Vision	<p>Ensure that clients have access to their glasses or contacts that are cleaned properly and have a current prescription. Provide magnifying glasses if needed.</p> <p>Identify yourself when entering the client's space.</p> <ul style="list-style-type: none"> Monitor functional implications of diminished vision. Provide adequate room lighting. Minimize glare (i.e., offer sunglasses or draw the window covering). Describe the environment to the client as needed. Avoid rearranging the environment. Maintain an uncluttered environment and remove hazards such as scatter rugs and oxygen tubing when possible. Identify items on food tray in relation to numbers on a clock. Provide reading materials in large print, as needed. Apply labels to frequently used items (e.g., mark medication bottles using high-contrasting colors). Encourage and assist in arranging routine vision assessments and screenings.

Hearing Impairment	<p>Perform or arrange for routine hearing assessments. Assist the client in acquiring a hearing aid or assistive hearing device when needed.</p> <p>Ensure appropriate use of assistive hearing aids as needed; maintain batteries and cleanliness of the equipment.</p> <ul style="list-style-type: none"> Gain client's attention before speaking. Avoid noisy background environments when speaking. Avoid communicating more than 2-3 feet away from the client. Use gestures, when necessary. Simplify language (i.e., do not use slang but do use short, simple sentences) as appropriate. Facilitate lipreading by facing the client directly in good lighting, allowing them to see your mouth while speaking. Avoid speaking with anything in your mouth (such as gum or a mint) and do not turn from them while speaking. Use a low, deep voice when speaking. For clients with severe hearing impairment, document their preferred method of communication (e.g., verbal, written, lipreading, or American Sign Language) in their plan of care.
Impaired Sensitivity to Odor	<p>Advise the client to check pilot lights in home appliances visually.</p> <p>Encourage the client to check expiration dates on food items and marking dates on leftovers in the refrigerator.</p>
Impaired Tactile Sensation	<p>Maintain water heater temperature at a safe range to avoid burns.</p> <p>Check the temperature of bath water with a thermometer.</p>
Impaired Oral Communication	<p>Listen to the client and provide sufficient time for their answer. Avoid childlike phrases and words.</p> <p>Ask questions that only require short or "yes" or "no" answers for clients with expressive aphasia.</p> <ul style="list-style-type: none"> Keep explanations simple. Provide a communication board or other alternative methods of communication as appropriate. Collaborate with a speech therapist to develop a plan for effective communication. Provide education to family/caregivers to facilitate communication.

Sensory Overload	<p>Plan and combine nursing activities to avoid interrupting rest time.</p> <p>Decrease noise level in the room and the hallway outside as much as possible, including both noises from medical devices and conversations.</p> <p>Close the room door if possible.</p>
Sensory Deprivation	<p>Provide meaningful stimuli such as the client's choice of television, radio, reading material, calendars, photos of family members, and pets.</p> <p>Provide social interaction as appropriate; encourage family members/caregivers to engage in meaningful conversations with individuals.</p>

Standards of Care

National Patient Safety Goals established by The Joint Commission include prevention of falls. Appropriately assessing the risk of falls for clients with sensory impairments and implementing effective nursing interventions to prevent falls help to meet this standard of care.⁴

Evaluation

Evaluate a client's progress toward the expected outcomes established. Include safety, functioning, ability to communicate, and satisfaction with quality of life when evaluating the effectiveness of interventions. Determine if changes in the plan of care are needed to better meet the needs of the individual.

4. The Joint Commission. (n.d.). *2021 National patient safety goals*.

<https://www.jointcommission.org/standards/national-patient-safety-goals/>

7.4 Putting It All Together

OPEN RESOURCES FOR NURSING (OPEN RN)

Review how to apply the nursing process for a client with impaired sensation in the following scenario.



Figure 7.5 Simulated Client Image

Client Scenario

Mr. Mitchell, age 87, is accompanied to the primary care clinic with his daughter Elise. See Figure 7.5¹ for a simulated image of Mr. Mitchell. Elise tells the nurse that her father has been increasingly withdrawn and she has difficulty getting in contact with him during the week by phone. She is concerned that he is experiencing depression. Mr. Mitchell is alert, well-groomed, and smiling. As the nurse begins the initial assessment interview, it is noted that Mitchell smiles and nods a lot but does not answer direct questions appropriately. Elise has shared that she has not noted problems

1. "[man-old-confused-angry-thinker-street-in-the-age-people-tourists.jpg](#)" by unknown is in the [Public Domain](#)

with her father's ability to care for himself; he is paying his own bills and orders groceries online for delivery.

When questioned further about his answers, Mr. Mitchell admits that he is unsure what was asked of him. He is embarrassed about this and avoids asking people to repeat themselves. He also explains that his father had a hearing device, and it always “rang loudly” so he has not considered this option.

The nurse performs a whisper test and discovers he is unable to report any of the six words whispered behind him. She notes that Mr. Mitchell is interested in improving his ability to hear and participate in conversations with others.

Applying the Nursing Process

Assessment: The nurse performs a whisper test and discovers he is unable to report any of the six words whispered behind him. He is interested in improving his ability to hear and participate in conversations with others.

Based on the interview and assessment information, the following nursing care plan is created for Mr. Mitchell.

Nursing Diagnosis: *Readiness for Enhanced Communication as evidenced by expressed desire to enhance hearing and communication.*

Overall Goal: *The client will experience enhanced communication with improved hearing.*

SMART Expected Outcome: *Mr. Mitchell will attend an appointment arranged with an audiologist within two weeks.*

Planning and Implementing Nursing Interventions:

The nurse provides education about available hearing devices and encourages the client to attend an appointment with an audiologist. While speaking to the client, she faces him directly and provides good lighting so that he can read her lips. She shuts the door to the exam room to provide a quiet environment and uses short, simple sentences. She does not interpret nodding to indicate understanding. She shares her assessment findings with the provider and requests a referral to an audiologist and then assists the client in making the appointment. She asks the client and his daughter if they have any questions before they leave the clinic.

Sample Documentation:

During the intake interview, the client answered some questions appropriately but at times did not answer questions at all. He appeared to be embarrassed when asking people to repeat their statements. Daughter states, "He is becoming increasingly withdrawn." Ear canals are clear without cerumen present. Unable to report six out of six words during the whisper test. Provided brief explanation of new technology available for hearing loss while standing directly in front of the client, and he appeared to be able to slightly read lips. Encouraged consultation with an audiologist and notified the provider of assessment findings. Appointment made with the audiologist and communicated place, date, and time to the client and his daughter.

Evaluation:

During the next clinic appointment in two weeks, Mr. Mitchell is wearing a hearing aid device and answers questions appropriately. He reports that he has been attending more social events "now that I can hear better." The SMART outcome was "met."

7.5 Learning Activities

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Activities

(Answers to “Learning Activities” can be found in the “Answer Key” at the end of the book. Answers to interactive activity elements will be provided within the element as immediate feedback.)

Practice Activity

Data Collection/Assessment

1. Working with a partner or a “simulated client,” use the following questions and actions listed to perform a sensory function assessment. Use critical thinking to ask as-needed follow-up questions.

Vision:

- Do you wear glasses or contact lenses?
- Do you have problems reading or doing close work? Do you have problems seeing far away objects?
- Do you have any floaters (spots) in your vision?
- When have you last had your eyes examined by an eye doctor?
- Is there a family history of glaucoma or other eye diseases?
- Have you ever had eye trauma or surgery?

- Read words from a book or newspaper.

Hearing:

- Do you currently have any ear pain, discharge, or hearing changes?
- Do you note yourself having trouble hearing in certain situations?
- Do you note any dizziness or ringing in your ears (tinnitus)?
- Do you work in an environment where you are exposed to loud noise on a regular basis? Do you wear protection on your ears from the noise?
- Have you taken any medications that came with a warning to report any changes in hearing?
- Have family members or friends mentioned that you seem not to hear?
- Perform the whisper test.

Smell:

- How is your sense of smell?
- Ask the client to identify some scents like coffee or lemons with eyes closed.

Touch:

- Ask the client to close their eyes and identify areas when you are touching them (i.e., the upper and lower extremities).
- Do you have unusual sensations or numbness and tingling?
- Ask the client to close their eyes and identify an object by touch, such as a key.

Taste:

- Have you noted any changes in your ability to taste foods?

- Is your appetite “normal” for you? Have you noted a decrease?
- Ask the client to taste and identify food such as sugar or salt.

Analysis and Care Planning

2. Create a nursing diagnosis based on your assessment findings.
3. Identify a client-centered goal and SMART expected outcomes.
4. Outline nursing interventions to help the client to meet the established goal and expected outcome.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=516#h5p-64>



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=516#h5p-18>



Test your knowledge using this [NCLEX Next Generation-style](#)

- ▶ [question](#). You may reset and resubmit your answers to this question an unlimited number of times.¹



- ▶ Test your knowledge using this [NCLEX Next Generation-style question](#). You may reset and resubmit your answers to this question an unlimited number of times.²

1. “Chapter 7 Assignment 1” by Tami Davis for [OpenRN](#) is licensed under [CC BY-NC 4.0](#)
2. “Chapter 7 Assignment 2” by Tami Davis for [OpenRN](#) is licensed under [CC BY-NC 4.0](#)

VII Glossary

OPEN RESOURCES FOR NURSING (OPEN RN)

Cataracts: Opacity of the lens of the eye that causes clouded, blurred, or dim vision. Cataracts can be removed with surgery that replaces the lens with an artificial lens. ([Chapter 7.2](#))

Diabetic retinopathy: A complication of diabetes mellitus due to damaged blood vessels in the retina. If found early, treatments, such as laser treatment that can help shrink blood vessels, injections that can reduce swelling, or surgery, can prevent permanent vision loss. ([Chapter 7.2](#))

Glaucoma: Gradual loss of peripheral vision caused by elevated intraocular pressure that leads to progressive damage to the optic nerve. ([Chapter 7.2](#))

Kinesthetic impairment: An altered sense of touch that can cause difficulty in performing fine motor tasks. ([Chapter 7.2](#))

Macular degeneration: Loss of central vision with symptoms such as blurred central vision, distorted vision that causes difficulty driving and reading, and the requirement for brighter lights and magnification for close-up visual activities. ([Chapter 7.2](#))

Perception: The interpretation of sensation during the sensory process. ([Chapter 7.2](#))

Presbycusis: Age-related hearing loss. ([Chapter 7.2](#))

Presbyopia: The impairment of near vision and accommodation as the lens of the eye gradually becomes thicker and loses flexibility as a person ages. ([Chapter 7.2](#))

Proprioception: The sense of the position of our bones, joints, and muscles. ([Chapter 7.2](#))

Reaction: The response that individuals have to a perception of a received stimulus. ([Chapter 7.2](#))

Reception: The initial part of the sensory process when a nerve cell or sensory receptor is stimulated by a sensation. ([Chapter 7.2](#))

Sensory deprivation: A condition that occurs when there is a lack of

sensations due to sensory impairments or when the environment has few quality stimuli. ([Chapter 7.2](#))

Sensory impairment: Any type of difficulty that an individual has with one of their five senses or sensory function. ([Chapter 7.2](#))

Sensory overload: A condition that occurs when an individual receives too many stimuli or cannot selectively filter meaningful stimuli. ([Chapter 7.2](#))

Somatosensation: Sensory receptors that respond to specific stimuli such as pain, pressure, temperature, and vibration; includes vestibular sensation and proprioception. ([Chapter 7.2](#))

Tinnitus: Hearing ringing in the ears. ([Chapter 7.2](#))

Vestibular sensation: A sense of spatial orientation and balance. ([Chapter 7.2](#))

PART VIII

OXYGENATION

8.1 Oxygenation

Introduction

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Objectives

- Identify risk factors in oxygenation alterations across the life span
- Identify cues related to alterations in oxygenation
- Identify safety considerations related to care of oxygenation alterations
- Identify interventions to plan care for client with oxygenation alterations
- Identify diagnostic tests and lab values related to oxygenation alterations
- Contribute to a plan of care for clients with oxygenation alterations

Sufficient oxygenation is vital to maintain life. When prioritizing nursing interventions, we often refer to using the “ABCs,” an acronym used to signify the importance of maintaining a client’s airway, breathing, and circulation. Several body systems work collaboratively during the oxygenation process to take in oxygen from the air, carry it through the bloodstream, and adequately oxygenate tissues. It is important that all parts of the system work together to ensure that oxygen is delivered appropriately to tissues within each system.

Any alteration in these systems can have catastrophic implications on a client's health. First, the airway must be open and clear. The chest and lungs must mechanically move air in and out of the lungs. The bronchial airways must be open so that air can reach the alveoli, where the exchange of oxygen and carbon dioxide occurs. The heart must effectively pump oxygenated blood from the lungs and through the systemic arteries. There must be adequate amounts of hemoglobin in the blood to sufficiently carry the oxygen molecules to the tissues. However, several medical conditions such as asthma, chronic obstructive pulmonary disease (COPD), pneumonia, heart disease, and anemia can impair the body's ability to effectively complete this oxygenation process.¹

This chapter will review these basic concepts related to oxygenation and apply the nursing process to clients who are experiencing alterations in oxygenation.

1. Ernstmeyer, K., & Christman, E. (Eds.). (2023). Nursing Skills 2e. Access for free at <https://wtcs.pressbooks.pub/nursingskills/>

8.2 Oxygenation Basic Concepts

OPEN RESOURCES FOR NURSING (OPEN RN)

Review of Anatomy and Physiology

Several body systems contribute to a person's oxygenation status, including the respiratory, cardiovascular, and hematological systems. The anatomy and physiology of these systems are reviewed in the following sections.

Respiratory System

The major organs of the respiratory system function primarily to provide oxygen to body tissues for cellular respiration, remove the waste product carbon dioxide, and help maintain acid-base balance.¹ See Figure 8.1 for an illustration of the major structures of the respiratory system.²

1. Betts, J. G., Desaix, P., Johnson, E., Johnson, J. E., Korol, O., Kruse, D., Poe, B., Wise, J., Womble, M. D., & Young, K. A. (2022). *Anatomy and physiology 2e*. OpenStax. Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/1-introduction>
2. "2301 Major Respiratory Organs.jpg" by OpenStax College is licensed under CC BY 4.0. Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/22-1-organs-and-structures-of-the-respiratory-system>

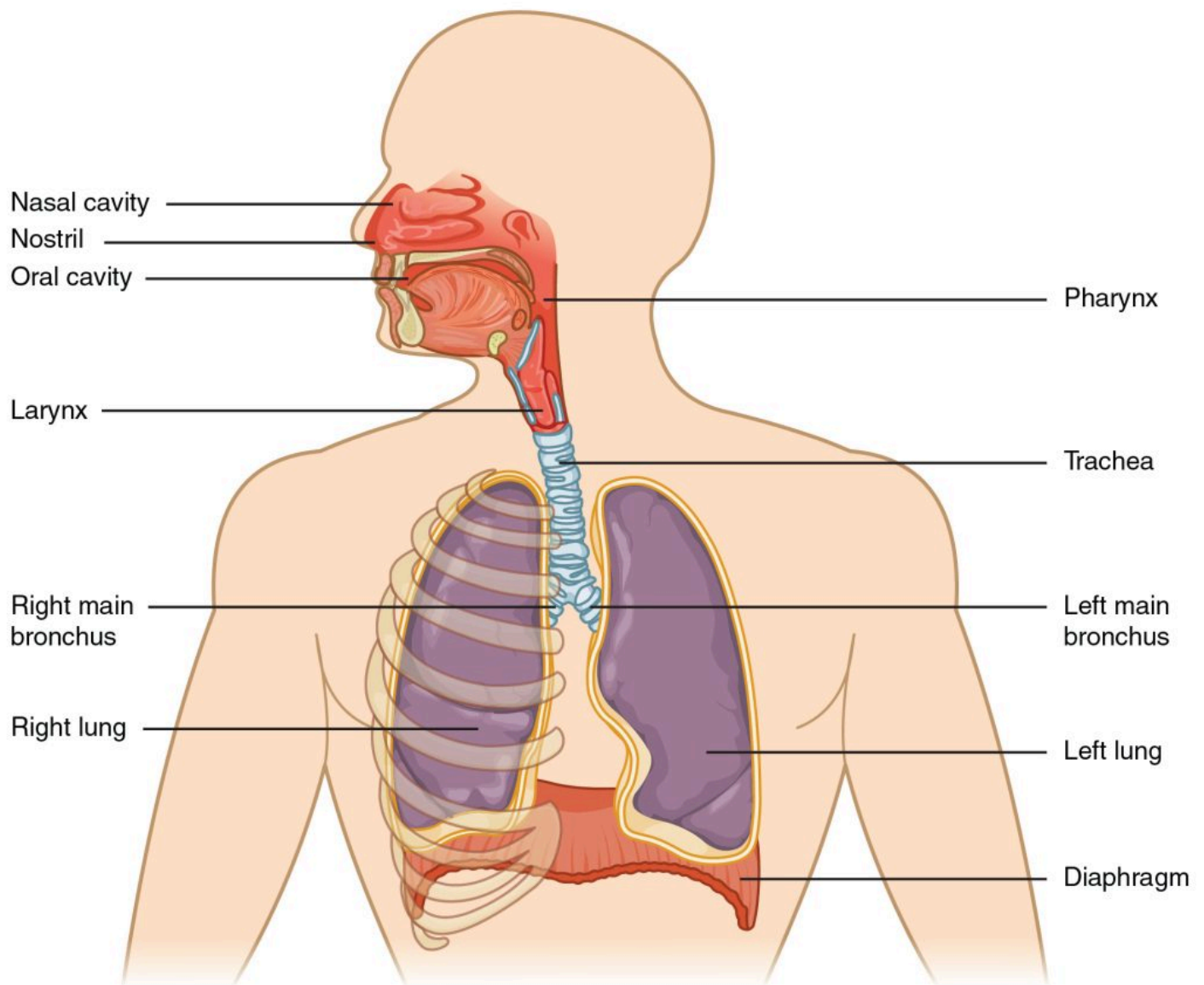


Figure 8.1 Major Respiratory Structures

The purpose of the respiratory system is to perform gas exchange. **Gas exchange** refers to the exchange of oxygen and carbon dioxide in the alveoli and the pulmonary capillaries, also called **respiration**. During external respiration, at the alveolar level, oxygen from the air we breathe diffuses into the blood, and carbon dioxide diffuses out of the blood where it can be exhaled. Throughout the rest of the body, gas exchange also occurs between the systemic capillaries and body cells/tissues, called internal respiration. During internal respiration, oxygen diffuses out of the systemic capillaries and

into body cells/tissues, and carbon dioxide diffuses from the cells/tissues into the systemic capillaries where it is carried to the lungs. It is through this process that cells in the body are oxygenated and carbon dioxide, the waste product of cellular respiration, is removed from the body.³ See Figure 8.2a⁴ for an illustration of alveoli.

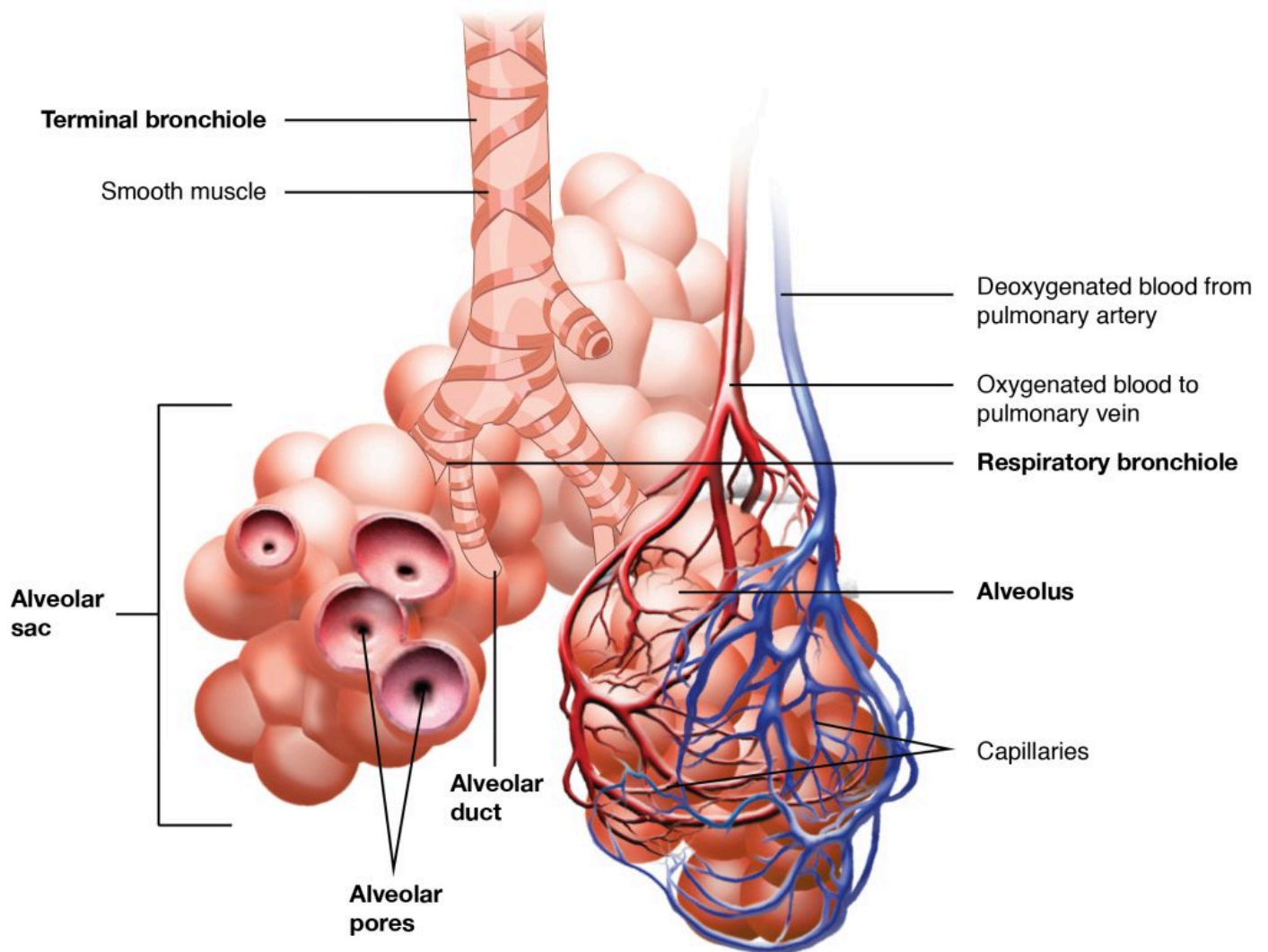


Figure 8.2a Alveoli

3. Ernstmeier, K., & Christman, E. (Eds.). (2024). *Medical Terminology 2e*. WisTech Open. Access for free at <https://wtcs.pressbooks.pub/medterm/>

4. "2309 The Respiratory Zone.jpg" by OpenStax College is licensed under CC BY 3.0. Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/22-1-organs-and-structures-of-the-respiratory-system>

To achieve gas exchange, the structures of the respiratory system create the mechanical movement of air into and out of the lungs called **ventilation**. Pulmonary ventilation provides air to the alveoli for this gas exchange process.

Lung sounds are caused by the movement of air from the trachea to the bronchioles to the alveoli and can be impacted by the presence of sputum, bronchoconstriction, or fluid in the alveoli. Examples of adventitious sounds are rhonchi (coarse crackles), rales (fine crackles), wheezes, stridor, and pleural rub⁵:

- **Rhonchi**, also referred to as coarse crackles, are low-pitched, continuous sounds heard on expiration that are a sign of turbulent airflow through mucus in the large airways.
- **Rales**, also called fine crackles, are popping or crackling sounds heard on inspiration. They are associated with medical conditions that cause fluid accumulation within the alveolar and interstitial spaces, such as heart failure or pneumonia. The sound is similar to that produced by rubbing strands of hair together close to your ear.
- **Wheezes** are whistling noises produced when air is forced through airways narrowed by bronchoconstriction or mucosal edema. For example, clients with asthma commonly have wheezing.
- **Stridor** is heard only on inspiration. It is associated with obstruction of the trachea/upper airway.
- **Pleural rub** sounds like the rubbing together of leather and can be heard on inspiration and expiration. It is caused by inflammation of the pleura membranes that results in friction as the surfaces rub against each other.

Several respiratory conditions can affect a client's ability to maintain adequate ventilation and respiration, and there are several medications used to enhance a client's oxygenation status.

5. Ernstmeyer, K., & Christman, E. (Eds.). (2023). *Nursing Skills 2e*. Access for free at <https://wtcs.pressbooks.pub/nursingskills/>

- ▶ Review common respiratory disorders and common respiratory medications in the “Respiratory” chapter in *Open RN Nursing Pharmacology, 2e*.
- ▶ Review how to perform a respiratory assessment in *Open RN Nursing Skills, 2e*.

Cardiovascular System

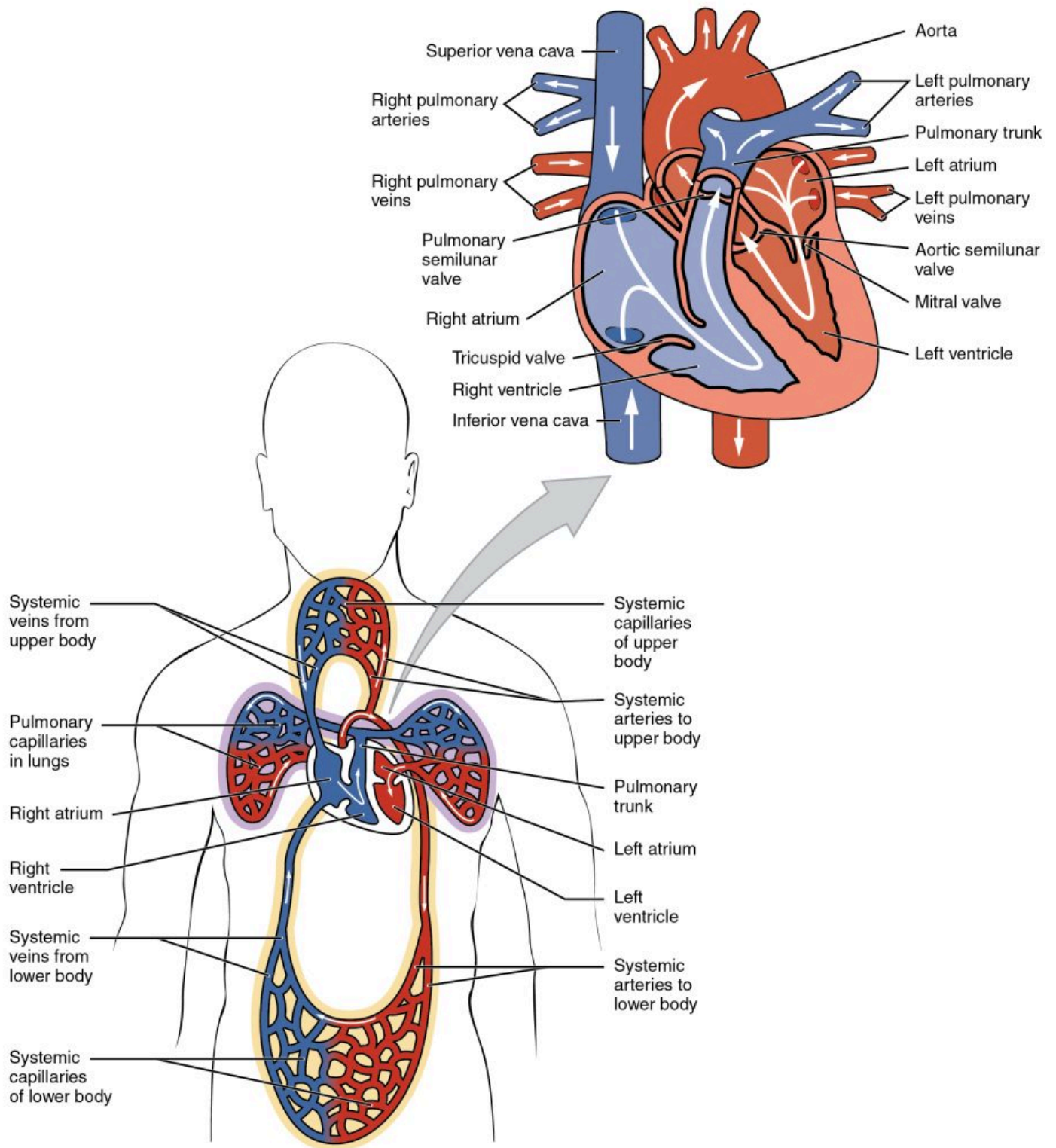
The heart consists of four chambers, including two atria and two ventricles. The right atrium receives deoxygenated blood from the systemic circulation, and the left atrium receives oxygenated blood from the lungs. The atria contract to push blood into the lower chambers, the right ventricle and the 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.

There are two distinct but linked circuits in the cardiovascular system called the pulmonary and systemic circuits. 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 body tissues and returns deoxygenated blood and carbon dioxide to the heart to be sent back to the pulmonary circulation.⁶ See Figure 8.2b⁷ for an illustration of

6. Betts, J. G., Desaix, P., Johnson, E., Johnson, J. E., Korol, O., Kruse, D., Poe, B., Wise, J., Womble, M. D., & Young, K. A. (2022). *Anatomy and physiology 2e*. OpenStax. Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/1-introduction>

7. “Dual System of the Human Blood Circulation” by OpenStax College is licensed under [CC By 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/19-1-heart-anatomy>

heart structures and blood flow through the heart and body. The blue areas indicate deoxygenated blood flow, and the red areas indicate oxygenated blood flow.



8.2b Major Heart Structures and Blood Flow Through the Heart and Body

In order for oxygenated blood to move from the alveoli in the lungs to the various organs and tissues of the body, the heart must adequately pump blood through the systemic arteries. The amount of blood that the heart pumps in one minute is referred to as **cardiac output**. The passage of blood through arteries to an organ or tissue is referred to as **perfusion**. Several cardiac conditions can adversely affect cardiac output and perfusion in the body. There are several medications used to enhance cardiac output and maintain adequate perfusion to organs and tissues throughout the body.

- ▶ Review [common cardiac disorders](#) and common [cardiovascular system medications](#) in the “Cardiovascular & Renal” chapter in *Open RN Nursing Pharmacology, 2e*.
- ▶ Review how to perform a [cardiovascular assessment](#) in *Open RN Nursing Skills, 2e*.

Hematological System

Although the bloodstream carries small amounts of dissolved oxygen, the majority of oxygen molecules are transported throughout the body by attaching to hemoglobin within red blood cells. Each hemoglobin protein is capable of carrying four oxygen molecules. When all four hemoglobin structures contain an oxygen molecule, it is referred to as “saturated.”⁸ See

8. Betts, J. G., Desaix, P., Johnson, E., Johnson, J. E., Korol, O., Kruse, D., Poe, B., Wise, J., Womble, M. D., & Young, K. A. (2022). *Anatomy and physiology 2e*. OpenStax. Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/1-introduction>

Figure 8.2c⁹ for an image of hemoglobin protein within a red blood cell with four sites for carrying oxygen molecules.

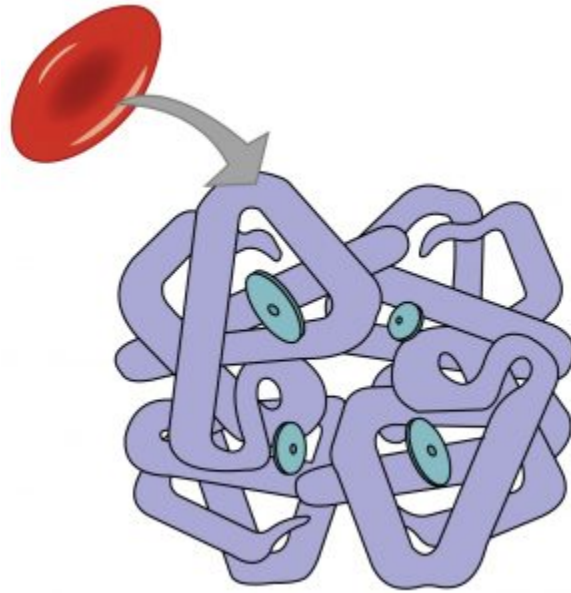


Figure 8.2c Hemoglobin

When oxygenated blood reaches tissues within the body, oxygen is released from the hemoglobin, and carbon dioxide is picked up and transported to the lungs for release on exhalation. Carbon dioxide is transported throughout the body by three major mechanisms: dissolved carbon dioxide, attachment to

9. "2322_Fig_23.33-a.jpg" by OpenStax is licensed under [CC BY 3.0](https://creativecommons.org/licenses/by/3.0/)

water as HCO_3^- , and attachment to the hemoglobin in red blood cells.¹⁰ See Figure 8.2d¹¹ for an illustration of carbon dioxide transport.¹²

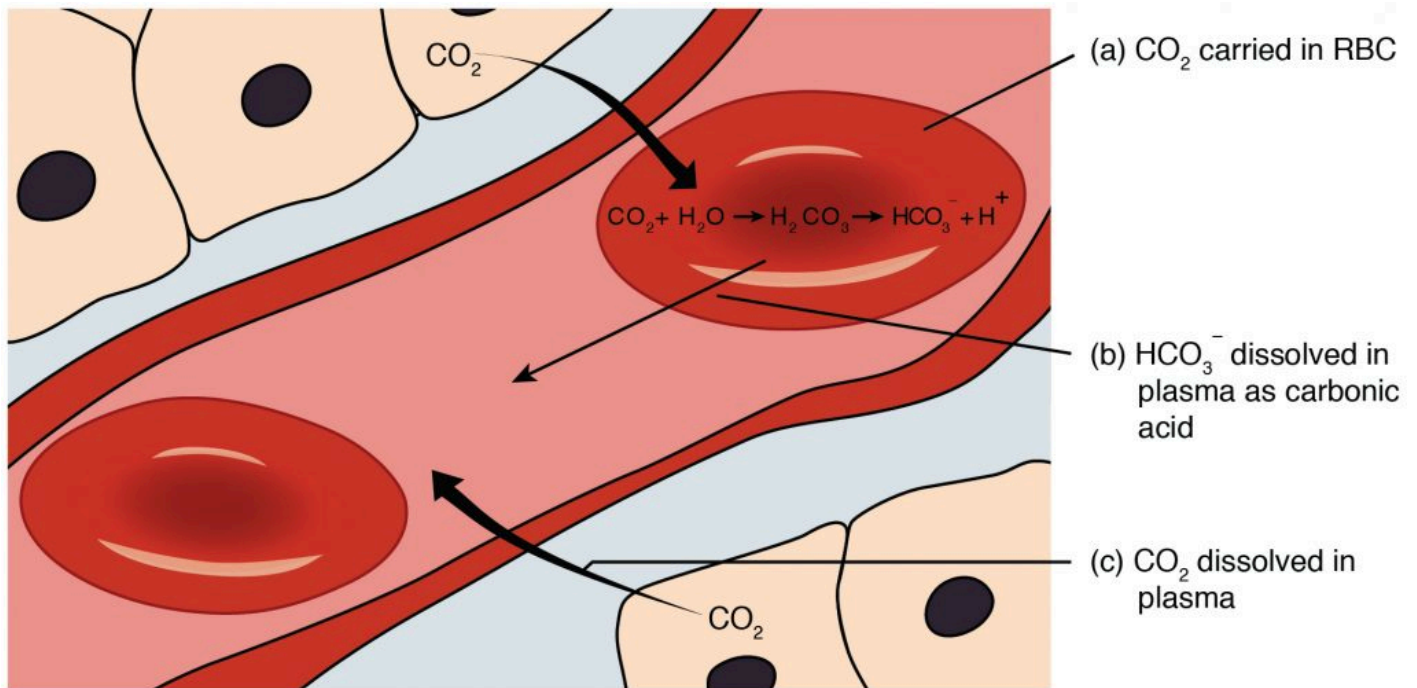


Figure 8.2d Carbon Dioxide Transport

10. Betts, J. G., Desaix, P., Johnson, E., Johnson, J. E., Korol, O., Kruse, D., Poe, B., Wise, J., Womble, M. D., & Young, K. A. (2022). *Anatomy and physiology 2e*. OpenStax. Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/1-introduction>

11. "2325_Carbon_Dioxide_Transport.jpg" by OpenStax is licensed under [CC BY 3.0](https://creativecommons.org/licenses/by/3.0/)

12. Betts, J. G., Desaix, P., Johnson, E., Johnson, J. E., Korol, O., Kruse, D., Poe, B., Wise, J., Womble, M. D., & Young, K. A. (2022). *Anatomy and physiology 2e*. OpenStax. Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/1-introduction>

Measuring Oxygen, Carbon Dioxide, and Acid Base Levels

Because the majority of oxygen transported in the blood is attached to hemoglobin, a client's oxygenation status is easily assessed using pulse oximetry, referred to as **saturation of peripheral oxygen (SpO₂)**. See Figure 8.3¹³ for an image of a pulse oximeter. This reading refers to the amount of hemoglobin that is saturated. The target range of SpO₂ for an adult is 94-98%.¹⁴

For clients with chronic oxygenation conditions such as COPD, the target range for SpO₂ is often lower at 88% to 92%, although the acceptable SpO₂ range should be specified by the provider. Although SpO₂ is an efficient, noninvasive method for assessing a client's oxygenation status, it is not always accurate, and data should be validated with other assessments. For example, if a client is severely anemic, the client has a decreased amount of hemoglobin in the blood available to carry the oxygen, which subsequently affects the SpO₂ reading. Decreased perfusion of the extremities can also cause inaccurate SpO₂ levels because less blood being delivered to the tissues can result in a false low SpO₂. Similarly, cool extremities can also cause a false low reading. Additionally, other substances can attach to hemoglobin such as carbon monoxide, causing a falsely elevated SpO₂.

13. "[OxyWatch_C20_Pulse_Oximeter.png](#)" by Thinkpaul is licensed under [CC BY-SA 3.0](#)

14. Patel, S. (2022). *Physiology, carbon dioxide retention*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK482456/>



Figure 8.3 Portable Pulse Oximeter

A more specific and accurate measurement of oxygen and carbon dioxide in the blood is obtained using an **arterial blood gas (ABG)**. ABG results are often used for clients who have a deteriorating or unstable respiratory status requiring emergency treatment. An ABG is a specific type of blood sample drawn from an artery, typically the radial artery, by a respiratory therapist, physician, lab technician, or specially trained RN. ABG results indicate oxygen, carbon dioxide, pH, and bicarbonate levels in the arterial blood and are a more accurate measure of oxygenation status than SpO₂¹⁵ :

- **PaO₂:** PaO₂ is the partial pressure of oxygen dissolved in the arterial blood and is a measure of how well oxygen is able to move from the lungs into the bloodstream. The normal PaO₂ level of a healthy adult is 80 to 100 mmHg. The PaO₂ reading is more accurate than a SpO₂ reading because it is not affected by hemoglobin levels.
- **PaCO₂:** PaCO₂ is the partial pressure of carbon dioxide dissolved in the arterial blood and measures how well carbon dioxide is able to move out of the body. It is typically used to determine if sufficient ventilation is

15. Castro, D. (2024). *Arterial blood gas*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK536919/>

occurring at the alveolar level. PaCO₂ levels are affected by the rate and depth of ventilation. Decreased ventilation causes increased PaCO₂ levels as gas exchange decreases and carbon dioxide is “retained.” The normal PaCO₂ level of a healthy adult is 35-45 mmHg.

- **pH level: Ph level** is a measurement of acidity or alkalinity of the blood. The normal range of pH level for arterial blood is 7.35-7.45. A pH level below 7.35 is considered acidic, causing a condition called acidosis, and a pH level above 7.45 is considered alkaline, causing a condition known as alkalosis. Hydrogen ions are acids that affect the acidity of the blood and are regulated by respiratory rate and depth. Increased hydrogen ions cause increased acidity, and decreased hydrogen ions mean there is less acidity in the blood. Bicarbonate levels affect the alkalinity of the blood.
- **HCO₃⁻: HCO₃⁻** is a measurement of bicarbonate levels in the blood. Bicarbonate is considered a buffer and is regulated by the kidneys. The kidneys retain HCO₃⁻ to make the blood more alkaline, and they excrete HCO₃⁻ to make the blood less alkaline. The normal range of HCO₃⁻ is 22-26.
- **SaO₂: SaO₂** is the calculated arterial oxygen saturation level. SaO₂ is similar to SpO₂ in that it measures oxygen levels in the blood, but the SaO₂ level is more accurate because it is not affected by poor perfusion, cool extremities, or carbon monoxide binding to hemoglobin. The normal SaO₂ range for a healthy adult is 95-100%.

Read more information about ABG values and ABG interpretation in the “[Acid-Base Balance](#)” section of the “Fluids and Electrolytes” chapter.

Hypoxia and Hypercapnia

Hypoxia is defined as a reduced level of tissue oxygenation. Hypoxia has many causes, ranging from respiratory and cardiac conditions to anemia.

Hypoxemia is a specific type of hypoxia that is defined as decreased partial pressure of oxygen in the blood (PaO₂) indicated in an arterial blood gas (ABG) result.

Early signs of hypoxia are related to the brain becoming starved of oxygen and include anxiety, confusion, and restlessness. As hypoxia worsens, the client'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. See Figure 8.4¹⁶ for an image of cyanosis.



Figure 8.4 Cyanosis

Hypercapnia, also referred to as hypercarbia, is an elevated level of carbon dioxide in the blood. This level is measured by the PaCO₂ level in an ABG test and is indicated when the PaCO₂ level is greater than 45. Hypercapnia is caused by hypoventilation or when the alveoli are ventilated but not perfused. In a state of hypercapnia, the accumulation of carbon dioxide in the blood causes the pH of the blood to decrease, leading to a state of respiratory acidosis. You can read more about respiratory acidosis in the “[Acid-Base Balance](#)” section of the “Fluids and Electrolytes” chapter.

It is important to note that some clients with hypercapnia may not initially exhibit changes in their vital signs. Instead, they may present with increased sedation or somnolence and decreased respiratory depth or rate. In these

¹⁶. “[Cynosis.JPG](#)” by [James Heilman, MD](#) is licensed under [CC BY-SA 3.0](#)

clients, SpO₂ may be normal, but this should not provide false reassurance that their condition is stable. As hypercapnia worsens, the client will become increasingly unstable and may experience respiratory arrest.

Clients with hypercapnia have symptoms such as tachycardia, dyspnea, flushed skin, confusion, headaches, and dizziness. In cases of opioid or narcotic overdose, clients may have increased sedation with shallow respirations. If the hypercapnia develops gradually over time, symptoms may be mild or may not be present at all.¹⁷

Hypercapnia is managed by the health care team by addressing its underlying cause. A noninvasive positive pressure device such as a BiPAP may be used to help eliminate the excess carbon dioxide. If noninvasive devices are not sufficient, intubation with an **endotracheal tube** and mechanical ventilation may be required.¹⁸

▶ Read more about BiPAP devices and intubation in the “[Oxygen Therapy](#)” chapter in *Open RN Nursing Skills, 2e*.

Nurses must recognize early signs of respiratory distress and promptly report changes in client condition to prevent respiratory failure. See Table 8.2a for symptoms and signs of respiratory distress.¹⁹

Table 8.2a Symptoms and Signs of Respiratory Distress

17. Patel, S. (2022). *Physiology, carbon dioxide retention*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK482456/>

18. Patel, S. (2022). *Physiology, carbon dioxide retention*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK482456/>

19. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus Pressbooks. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

Signs and Symptoms	Description
Shortness of breath (Dyspnea)	Dyspnea is a subjective feeling of not getting enough air. Depending on its severity, dyspnea can cause increased levels of anxiety.
Restlessness	An early sign of hypoxia resulting in increased movement and the inability to stay still.
Tachycardia	An elevated heart rate (above 100 beats per minute in adults) at rest can be an early sign of hypoxia.
Tachypnea	An increased respiration rate (above 20 breaths per minute in adults) at rest can be an indication of respiratory distress.
Oxygen saturation level (SpO₂)	Oxygen saturation levels should be above 94% for adults who do not have an underlying respiratory condition. New SpO ₂ reading less than 92% may indicate hypoxia and require notification of the provider. SpO ₂ less than 88% may indicate severe hypoxia and require medical intervention. ²⁰
Use of accessory muscles	Use of neck or intercostal muscles when breathing is an indication of respiratory distress.
Noisy breathing	Audible noises with breathing are an indication of respiratory conditions. Further assess lung sounds with a stethoscope for adventitious sounds such as wheezing, rales, or crackles. Secretions can plug the airway, thereby decreasing the amount of oxygen available for gas exchange in the lungs.
Flaring of nostrils	Nasal flaring is a sign of respiratory distress, especially in infants.
Skin color (Cyanosis)	Bluish changes in skin color and mucus membranes is a late sign of hypoxia.
Position of client	Clients in respiratory distress often automatically sit up and lean over by resting arms on their legs, referred to as the tripod position. The tripod position enhances lung expansion. Conversely, clients who are hypoxic often feel worse dyspnea when lying flat in bed and avoid the supine position.
Ability of client to speak in full sentences	Clients in respiratory distress may be unable to speak in full sentences or may need to catch their breath between sentences.

New confusion or change in level of consciousness (LOC)	New confusion or changing level of consciousness can be an early sign of hypoxia resulting from lack of oxygen to the brain.
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Treating Hypoxia and Hypercapnia

Hypoxia and/or hypercapnia are medical emergencies and should be treated promptly by calling for assistance as indicated by agency policy.

Failure to initiate oxygen therapy when needed can result in serious harm or death of the client. Although oxygen is considered a medication that requires a prescription, oxygen therapy may be initiated without a physician’s order in emergency situations as part of the nurse’s response to the “ABCs,” a common abbreviation for airway, breathing, and circulation. Most agencies have a protocol in place that allows nurses to apply oxygen in emergency situations and obtain the necessary order at a later time.²¹ Be aware of your specific agency policy.

In addition to administering oxygen therapy, there are several other interventions a nurse can implement to assist an hypoxic client. Additional interventions used to treat hypoxia in conjunction with oxygen therapy are outlined in Table 8.2b.

Table 8.2b Interventions to Manage Hypoxia

20. Yale Medicine. (2024). *Pulse oximetry*. <https://www.yalemedicine.org/conditions/pulse-oximetry>

21. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus Pressbooks. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

Interventions	Additional Information
Raise the head of the bed.	Raising the head of the bed to high Fowler’s position promotes effective chest expansion and diaphragmatic descent, maximizes inhalation, and decreases the work of breathing.
Use tripod positioning.	Situate the client in a tripod position. Clients who are short of breath may gain relief by sitting upright and leaning over a bedside table while in bed, which is called a three-point or tripod position. The tripod position allows for increased lung expansion as gravity helps open the chest during inspiration.
Encourage enhanced breathing and coughing techniques.	Enhanced breathing and coughing include techniques such as pursed-lip breathing, coughing and deep breathing, huffing technique, and use of incentive spirometry and flutter valves. These techniques may assist clients to clear their airway, open alveoli to prevent atelectasis, and maintain good oxygen saturation levels. See the “Enhanced Breathing and Coughing Techniques” section below for additional information regarding these techniques.
Manage oxygen therapy and equipment.	<p>If the client is already on supplemental oxygen, ensure the equipment is turned on, set at the required flow rate, and is properly connected to an oxygen supply source. If a portable tank is being used, check the oxygen level in the tank. Ensure the connecting oxygen tubing is not kinked, which could obstruct the flow of oxygen. Feel for the flow of oxygen from the exit ports on the oxygen equipment and ensure the oxygen device is applied correctly on the client. In hospitals where medical air and oxygen are used, ensure the client is connected to the oxygen flow port.</p> <p>Various types of oxygenation equipment are prescribed for clients requiring oxygen therapy. Oxygenation equipment is typically managed in collaboration with a respiratory therapist in hospital settings. Equipment includes devices such as nasal cannula, masks, Continuous Positive Airway Pressure (CPAP), Bilevel Positive Airway Pressure (BiPAP), and mechanical ventilators. For more information, see the “Oxygenation Equipment” section of the “Oxygen Therapy” chapter in <i>Open RN Nursing Skills, 2e</i>.</p>
Assess the need for respiratory medications.	Pharmacological management is essential for clients with respiratory disease such as asthma, COPD, or severe allergic response. Bronchodilators effectively relax smooth muscles and open airways. Glucocorticoids relieve inflammation and also assist in opening air passages. Mucolytics decrease the thickness of pulmonary secretions so that they can be expectorated more easily. See the “ Respiratory System ” chapter in <i>Open RN Nursing Pharmacology, 2e</i> for additional information on respiratory medications.

<p>Provide suctioning, if needed.</p>	<p>Some clients may have a weakened cough that inhibits their ability to clear secretions from the mouth and throat. Clients with muscle disorders or those who have experienced a stroke (i.e., cerebral vascular accident) are at risk for aspiration, which could lead to pneumonia and hypoxia. Provide oral suction if the client is unable to clear secretions from the mouth and pharynx. See the “Tracheostomy Care and Suctioning” chapter in <i>Open RN Nursing Skills, 2e</i> for additional details on suctioning.</p>
<p>Provide pain relief, if needed.</p>	<p>Provide adequate pain relief if the client is reporting pain. Pain increases anxiety and metabolic demands, which, in turn, increases the need for more oxygen supply. Pain medications such as morphine can also be used to decrease the work of breathing in clients experiencing air hunger, a severe form of dyspnea.</p>
<p>Consider side effects of pain medication.</p>	<p>A common side effect of pain medication is respiratory depression. For more information about managing respiratory depression, see the “Pain Management” section of the “Comfort” chapter.</p>
<p>Consider other devices to enhance clearance of secretions.</p>	<p>Chest physiotherapy and specialized devices assist with secretion clearance, such as handheld flutter valves or vests that inflate and vibrate the chest wall. These techniques are helpful to mobilize secretions and stimulate coughing to clear secretions out of the airway. Consult with a respiratory therapist as needed based on the client’s situation.</p>
<p>Plan frequent rest periods between activities.</p>	<p>Plan interventions for clients with dyspnea so they can rest frequently and decrease oxygen demand.</p>
<p>Consider other potential causes of dyspnea.</p>	<p>If a client’s level of dyspnea is worsening, assess for other underlying causes in addition to the primary diagnosis. For example, are there other respiratory, cardiovascular, or hematological conditions occurring? Start by reviewing the client’s most recent hemoglobin and hematocrit lab results, as well as any other diagnostic tests such as chest X-rays and ABG results. Completing a thorough assessment may reveal abnormalities in these systems to report to the health care provider.</p>

<p>Consider obstructive sleep apnea.</p>	<p>Clients with obstructive sleep apnea (OSA) are often not previously diagnosed prior to hospitalization. OSA refers to cessation of breathing while sleeping and is caused by the partial or full collapse of the airway as muscles relax during sleep. This obstructs the airway and prevents air from moving in and out of the lungs during sleep. The nurse may notice the client snores, has pauses in breathing while snoring, has decreased oxygen saturation levels while sleeping, or awakens feeling not rested. These signs may indicate the client is unable to maintain an open airway while sleeping, resulting in periods of apnea and hypoxia. If these apneic periods are noticed but have not been previously documented, the nurse should report these findings to the health care provider for further testing and follow-up. A prescription for a CPAP or BiPAP device while sleeping may be needed to keep the airway open during sleep and to prevent adverse outcomes.</p>
<p>Monitor client's anxiety.</p>	<p>Assess client's anxiety. Anxiety often accompanies the feeling of dyspnea and can worsen dyspnea. Anxiety in clients with COPD is chronically undertreated. It is important for the nurse to address the feelings of anxiety in addition to the feelings of dyspnea. Anxiety can be relieved by teaching enhanced breathing and coughing techniques, encouraging relaxation techniques, or administering prescribed antianxiety medications like benzodiazepines. Read additional information about benzodiazepines in the "CNS Depressant" section of the "CNS System" chapter of <i>Open RN Nursing Pharmacology, 2e</i>.</p>

Enhanced Breathing and Coughing Techniques

In addition to oxygen therapy and the interventions listed in Table 8.2b, there are several techniques a nurse can teach a client to use to enhance their breathing and coughing. These techniques include pursed-lip breathing, incentive spirometry, coughing and deep breathing, and the huffing technique. Additionally, vibratory positive expiratory pressure (PEP) therapy can be incorporated in collaboration with a respiratory therapist.

PURSED-LIP BREATHING

Pursed-lip breathing is a technique that decreases dyspnea by teaching people to control their oxygenation and ventilation. See Figure 8.5²² for an

22. "v4-460px-Live-With-Chronic-Obstructive-Pulmonary-Disease-Step-8.jpg" by

illustration of pursed-lip breathing. The technique teaches a person to inhale through the nose and exhale through the mouth at a slow, controlled flow. This type of exhalation gives the person a puckered or pursed-lip appearance. By prolonging the expiratory phase of respiration, a small amount of positive end-expiratory pressure (PEEP) is created in the airways that helps to keep them open so that more air can be exhaled. This subsequently reduces air trapping that commonly occurs in conditions such as chronic obstructive pulmonary disease (COPD). Pursed-lip breathing 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.²³



Figure 8.5 Pursed-Lip Breathing

INCENTIVE SPIROMETRY

An **incentive spirometer** is a medical device commonly prescribed after

unknown is licensed under [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/). Access for free at <https://www.wikihow.com/Live-With-Chronic-Obstructive-Pulmonary-Disease>

23. Nguyen, J. D. (2023). *Pursed-Lip Breathing*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK545289/>

surgery to expand the lungs to keep alveoli open, reduce the buildup of fluid in the lungs, and prevent pneumonia. See Figure 8.6²⁴ for an image of a client using an incentive spirometer. While sitting upright, if possible, the client should exhale fully, place the mouthpiece in their mouth and create a tight seal with their lips around it. They should breathe in slowly and as deeply as possible through the tubing with the goal of raising the piston to their prescribed level. The resistance indicator on the right side should be monitored to ensure they are not breathing in too quickly. The client should attempt to hold their breath for as long as possible (at least five seconds) and then exhale and rest for a few seconds. Coughing is expected due to alveoli stretching to open more fully. Encourage the client to expel any mucus produced and not swallow it. This technique should be repeated by the client ten times every hour while awake.²⁵ The nurse may delegate this intervention to unlicensed assistive personnel, but the frequency in which it is completed, and the volume achieved should be documented and monitored by the nurse.

24. "[Incentive Spirometer.png](#)" by [BruceBlau](#)s is licensed under [CC BY-SA 4.0](#)

25. Cleveland Clinic. (2022). *Incentive spirometer*. <https://my.clevelandclinic.org/health/articles/4302-incentive-spirometer>



How to Use an Incentive Spirometer

Figure 8.6 Using an Incentive Spirometer



Using an incentive spirometer can feel monotonous to clients, resulting in the lack of performing this important activity to prevent pneumonia. It is helpful to encourage clients to create easy reminders to complete the activity. For example, many clients watch television. Create the reminder to use the incentive spirometer each time they view a commercial. This is a helpful trigger to use the incentive spirometer frequently.

COUGHING AND DEEP BREATHING

Coughing and deep breathing is a breathing technique similar to incentive spirometry but no device is required. The client is encouraged to take deep, slow breaths and then exhale slowly. After each set of breaths, the client should cough. This technique is repeated three to five times every hour. Similar to an incentive spirometer, the purpose of coughing and deep

breathing is to keep the airways open and clear of mucus to prevent atelectasis and pneumonia.

HUFFING TECHNIQUE

The **huffing technique** is helpful to teach clients who have difficulty coughing. Teach the client to inhale with a medium-sized breath and then make a sound like “ha” to push the air out quickly with the mouth slightly open.

VIBRATORY PEP THERAPY

Vibratory Positive Expiratory Pressure (PEP) Therapy uses handheld devices such as flutter valves or Acapella devices for clients who need assistance in clearing mucus from their airways. These devices require a prescription and are used in collaboration with a respiratory therapist or advanced health care provider. To use vibratory PEP therapy, the client should sit up, take a deep breath, and blow into the device. A flutter valve within the device creates vibrations that help break up the mucus so the client can cough and spit it out. Additionally, a small amount of positive end-expiratory pressure (PEEP) is created in the airways that helps to keep them open so that more air can be exhaled. See the supplementary video below regarding how to use the flutter valve device.

 View this video on [Using a Flutter Valve Device \(Acapella\)](#).²⁶

26. NHS University Hospitals Plymouth Physiotherapy. (2015, May 12). *Acapella* [Video]. YouTube. All rights reserved. <https://youtu.be/XOvonQVCE6Y>

8.3 Applying the Nursing Process

OPEN RESOURCES FOR NURSING (OPEN RN)

Now that we have discussed various concepts related to oxygenation and hypoxia, we will explain how a nurse uses the nursing process to care for clients with alterations in oxygenation.

Assessment

When assessing a client's oxygenation status, there are several subjective and objective assessments to include.

Subjective Assessment

The primary symptom to assess when a client is experiencing decreased oxygenation is their level of dyspnea, the medical term for the subjective feeling of shortness of breath or difficulty breathing. Clients can be asked to rate their dyspnea on a scale of 0-10, similar to using a pain rating scale.¹ The feeling of dyspnea can be very disabling for clients. There are many interventions that a nurse can implement to help improve the feeling of dyspnea and, thus, improve a client's overall quality of life.

It is also important to ask clients if they are experiencing a cough. If a cough is present, determine if sputum is present, and if so, the color and amount of sputum. **Sputum** is mucus and other secretions that are coughed up and

1. Registered Nurses' Association of Ontario. (2005). *Nursing care of dyspnea: The 6th vital sign in individuals with chronic obstructive pulmonary disease*. <https://rnao.ca/bpg/guidelines/dyspnea>

expelled from the mouth. The body always produces mucus to keep the delicate tissues of the respiratory tract moist so small particles of foreign matter can be trapped and forced out, but when there is an infection in the lungs, an excess of mucus is produced. The body attempts to get rid of this excess by coughing it up as sputum. The color of a client's sputum can provide cues for underlying medical conditions. For example, sputum caused by a respiratory infection is often yellow, green, or brown and often referred to as **purulent sputum**.² See Figure 8.7³ for an image of purulent sputum.



Figure 8.7 Purulent Sputum

Clients should be asked if they are experiencing chest pain. Chest pain can occur with several types of respiratory and cardiac conditions, some of which are emergent. If the client reports chest pain, first determine if it is an emergency by asking questions such as:

2. Barrel, A. (2017). What is a sputum culture test? *MedicalNewsToday*.
<https://www.medicalnewstoday.com/articles/318924#what-is-a-sputum-culture-test>
3. "Sputnum.JPG" by [Zhangmoon618](#) is licensed under [CC0](#)

- “Does it feel like something is sitting on your chest?”
- “Is the pain radiating into your jaw or arm?”
- “Do you feel short of breath, dizzy, or nauseated?”

If any of these symptoms are occurring, seek emergency medical assistance according to agency policy. If it is not a medical emergency, perform a focused assessment on the chest pain, including onset, location, duration, characteristics, alleviating or aggravating factors, radiation, and if any treatment has been used for the pain.⁴ Noncardiac chest pain tends to worsen with coughing and deep breathing.

Objective Assessment

Focused objective assessments for a client suspected of experiencing decreased oxygenation include assessing the airway; evaluating respiratory rate, effort, and quality; analyzing pulse oximetry readings; auscultating lung sounds for adventitious sounds; and evaluating the heart rate for tachycardia.

▶ Review detailed interview questions and how to perform a physical examination of the respiratory system in the “[Respiratory Assessment](#)” chapter in the *Open RN Nursing Skills, 2e* textbook.

Signs of cyanosis or clubbing should be noted. **Clubbing** is the enlargement of the fingertips that occurs with chronic hypoxia such as in chronic obstructive pulmonary disease (COPD) or congenital deficits in pediatric clients. See Figure 8.8⁵ for an image of clubbing.

4. U.S. National Library of Medicine. (2024). *Chest pain*. MedlinePlus. <https://medlineplus.gov/ency/article/003079.htm>

5. “[Acopaquia.jpg](#)” by Desherinka is licensed under [CC BY-SA 4.0](#)



Figure 8.8 Clubbing of Fingertips

Another sign of chronic hypoxia that often occurs in clients with chronic respiratory diseases like COPD includes an increased anterior-posterior chest diameter, often referred to as a **barrel chest**. A barrel chest results from air trapping in the alveoli. See Figure 8.9⁶ for an image of a barrel chest.



Figure 8.9 Comparison of Chest with Normal Anterior/Posterior Diameter (A) to a Barrel Chest(B)

6. "[Normal A-P Chest Image.jpg](#)" and "[Barrel Chest.jpg](#)" by Meredith Pomietlo for [Chippewa Valley Technical College](#) are licensed under [CC BY 4.0](#)

DIAGNOSTIC TESTS AND LAB WORK

Diagnostic tests and lab work are based on the client's medical condition that is causing the decreased oxygenation. For example, clients with a productive cough may have a chest X-ray or sputum culture ordered, and clients experiencing respiratory distress often have arterial blood gas (ABG) tests performed.

A chest X-ray is a fast and painless imaging test that uses certain electromagnetic waves to create pictures of the structures in and around the chest. This test can help diagnose and monitor conditions such as pneumonia, heart failure, lung cancer, and tuberculosis. Health care providers also use chest X-rays to see how well certain treatments are working and to check for complications after certain procedures or surgeries. Chest X-rays are contraindicated during pregnancy.^{7,8} See Figure 8.10⁹ for an image of a chest X-ray.

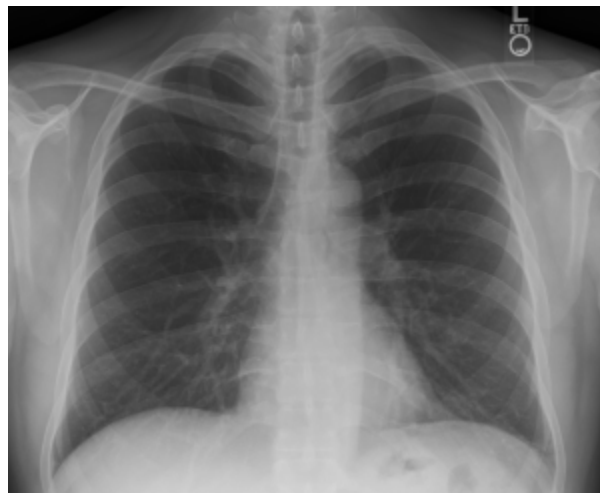


Figure 8.10 Chest X-ray

7. National Heart, Lung, and Blood Institute. (n.d.). *Chest x-ray*.

<https://www.nhlbi.nih.gov/health-topics/chest-x-ray>

8. U.S. National Library of Medicine. (2022). *Chest X-ray*. MedlinePlus.

<https://medlineplus.gov/ency/article/003804.htm>

9. "Chest Xray PA 3-8-2010.png" by [Stillwaterising](#) is licensed under [CC0](#)

A sputum culture is a diagnostic test that evaluates the type and number of bacteria present in sputum. The client 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 and is watched for two to three days or longer to see if bacteria or other disease-causing germs grow. The data is used to determine appropriate antimicrobial therapy.¹⁰ See Figure 8.11¹¹ for an image of a sputum culture.

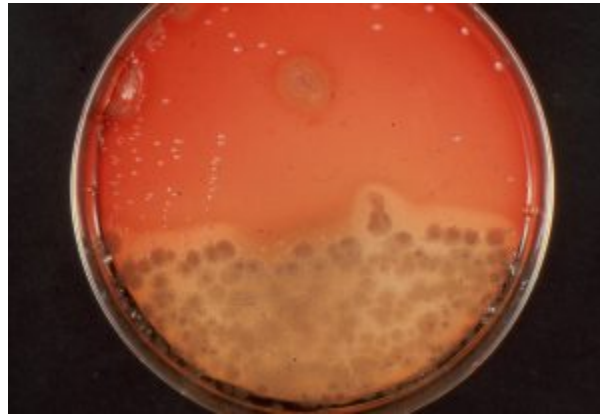


Figure 8.11 Sputum Culture

For clients experiencing respiratory distress, arterial blood gas (ABG) tests are often ordered. Additional details about ABG tests are discussed in the “[Oxygenation Basic Concepts](#)” section of this chapter, as well as in the “[Acid-Base Balance](#)” section of the “Fluid and Electrolytes” chapter. See Table 8.3a for a summary of normal ranges of ABG values in adults.

Table 8.3a Normal Ranges of ABG Values in Adults

10. U.S. National Library of Medicine. (2023). Sputum culture. MedlinePlus. <https://medlineplus.gov/ency/article/003723.htm>

11. “[m241-8 Blood agar culture of sputum from patient with pneumonia. Comprised host. Colonies of Candida albicans and pseudomonas aeruginosa \(LeBeau\)](#)” by Microbe World is licensed under [CC BY-NC-SA 2.0](#)

Value	Description	Normal Range
pH	Acid-base balance of blood	7.35-7.45
PaO ₂	Partial pressure of oxygen	80-100 mmHg
PaCO ₂	Partial pressure of carbon dioxide	35-45 mmHg
HCO ₃	Bicarbonate level	22-26 mEq/L
SaO ₂	Calculated oxygen saturation	95-100%

Diagnoses

Commonly used NANDA-I nursing diagnoses for clients experiencing decreased oxygenation and dyspnea include *Impaired Gas Exchange*, *Ineffective Breathing Pattern*, *Ineffective Airway Clearance*, *Decreased Cardiac Output*, and *Decreased Activity Tolerance*.¹² See Table 8.3b for definitions and selected defining characteristics for these commonly used nursing diagnoses. Use a current, evidence-based nursing care plan resource when creating a care plan for a client.

Table 8.3b NANDA-I Nursing Diagnoses Related to Decreased Oxygenation and Dyspnea¹³

12. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.
13. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.

NANDA-I Nursing Diagnoses	Definition	Selected Defining Characteristics
Impaired Gas Exchange	Excess or deficit in oxygenation and/or carbon dioxide elimination	<ul style="list-style-type: none"> • Abnormal arterial pH • Abnormal skin color • Altered respiratory depth or rhythm • Bradypnea • Confusion • Hypercapnia • Hypoxia or hypoxemia • Irritable mood • Nasal flaring • Psychomotor agitation • Tachycardia • Tachypnea • Somnolence

<p>Ineffective Breathing Pattern</p>	<p>Inspiration and/or expiration that does not provide adequate ventilation.</p>	<ul style="list-style-type: none"> • Abnormal breathing pattern • Bradypnea • Cyanosis • Dyspnea • Hypercapnia • Hyperventilation • Hypoventilation • Increased anterior-posterior chest diameter • Nasal flaring • Orthopnea • Pursed-lip breathing • Tachypnea • Uses accessory muscles to breathe • Uses three-point positioning
<p>Ineffective Airway Clearance</p>	<p>Reduced ability to clear secretions or obstructions from the respiratory tract to maintain a clear airway.</p>	<ul style="list-style-type: none"> • Absence of cough • Adventitious breath sounds • Altered respiratory rhythm • Bradypnea • Excessive sputum • Ineffective sputum elimination • Orthopnea • Psychomotor agitation • Uses accessory muscles to breathe

Decreased Cardiac Output	Inadequate volume of blood pumped by the heart to meet the metabolic demands of the body.	<ul style="list-style-type: none"> • Anxiety • Bradycardia • Adventitious breath sounds • Abnormal skin color • Tachycardia • Psychomotor agitation • Fatigue • Edema • Weight gain • Decreased peripheral pulses
Decreased Activity Tolerance	Insufficient endurance to complete required or desired daily activities.	<ul style="list-style-type: none"> • Exertional dyspnea • Expresses fatigue • Abnormal heart rate or blood pressure response to activity • Generalized weakness

For example, nurses commonly care for clients with chronic obstructive pulmonary disease (COPD). To select an accurate nursing diagnosis for a specific client with COPD, the nurse compares assessment findings with the defining characteristics of various nursing diagnoses. The nurse may select *Ineffective Breathing Pattern* after validating this client is demonstrating the associated signs and symptoms related to this nursing diagnosis:

- Dyspnea
- Increase in anterior-posterior chest diameter (e.g., barrel chest)
- Nasal flaring
- Orthopnea
- Prolonged expiration phase

- Pursed-lip breathing
- Tachypnea
- Use of accessory muscles to breathe
- Use of three-point position

Outcome Identification

A broad goal(s) for clients experiencing alterations in oxygenation is:

- *The client will have adequate movement of air into and out of the lungs*

A sample “SMART” outcome for a client experiencing dyspnea is:

- *The client’s reported level of dyspnea will be within their stated desired range of 1-2 throughout their hospital stay.*

Planning Interventions

Anxiety Reduction and *Respiratory Monitoring* are common categories of independent nursing interventions used to care for clients experiencing dyspnea and alterations in oxygenation. *Anxiety Reduction* refers to minimizing apprehension, dread, foreboding, or uneasiness related to an unidentified source of anticipated danger. *Respiratory Monitoring* refers to the collection and analysis of patient data to ensure airway patency and adequate gas exchange.”¹⁴ Selected nursing interventions related to anxiety reduction and respiratory monitoring are listed in the following box.

14. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.

Selected Nursing Interventions to Reduce Anxiety and Perform Respiratory Monitoring¹⁵

Anxiety Reduction

- Use a calm, reassuring approach
- Explain all procedures, including sensations likely to be experienced during the procedure
- Seek to understand the person's perspective of stressful situations
- Provide information concerning diagnosis, treatment, and prognosis
- Stay with the client to promote safety and reduce fear
- Encourage the family to stay with the client, as appropriate
- Listen attentively
- Create an atmosphere of trust
- Encourage verbalization of feelings, perceptions, and fears
- Identify when level of anxiety changes
- Provide diversional activities geared toward the reduction of tension
- Instruct the client on the use of relaxation techniques (e.g., guided imagery, music, massage, aroma therapy, art therapy, yoga, Tai Chi)
- Administer medications to reduce anxiety, as appropriate

Respiratory Monitoring

15. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.

- Monitor rate, rhythm, depth, and effort of respirations
- Note chest movement, watching for symmetry, use of accessory muscles, and supraclavicular and intercostal muscle retractions
- Monitor for noisy respirations such as snoring
- Monitor breathing patterns (e.g., bradypnea, tachypnea, hyperventilation, Kussmaul respirations, and Cheyne-Stokes respirations)
- Monitor oxygen saturation levels continuously in sedated clients
- Provide for noninvasive continuous oxygen sensors with appropriate alarm systems in clients with risk factors per agency policy and as indicated
- Auscultate lung sounds, noting areas of decreased or absent ventilation and presence of adventitious sounds
- Monitor client's ability to cough effectively
- Note onset, characteristics, and duration of cough
- Monitor the client's respiratory secretions
- Determine the need for suctioning
- Provide frequent intermittent monitoring of respiratory status in at-risk clients
- Monitor for dyspnea and events that improve and worsen it
- Monitor chest X-ray reports as appropriate
- Note changes in ABG values if ordered and notify provider as appropriate
- Institute resuscitation efforts as needed
- Institute respiratory therapy treatments (e.g., nebulizer) as needed

In addition to the independent nursing interventions listed in the preceding

box, several nursing interventions can be implemented to manage hypoxia, such as teaching enhanced breathing and coughing techniques, repositioning, managing oxygen therapy, administering medications, and providing suctioning. Refer to Table 8.2b in the “[Oxygenation Basic Concepts](#)” section earlier in this chapter for information about these interventions.

- ▶ For additional details regarding managing oxygen therapy, see the “[Oxygen Therapy](#)” chapter in *Open RN Nursing Skills, 2e*.
- ▶ Read more information about [respiratory medications](#) in the “Respiratory” chapter in *Open RN Nursing Pharmacology, 2e*.

Clients should also receive individualized health promotion teaching to enhance their respiratory status. Health promotion teaching includes encouraging activities such as the following:

- Receiving an annual influenza vaccine
- Receiving a pneumococcal vaccine every five years as indicated
- Stopping smoking
- Drinking adequate fluids to thin respiratory secretions
- Participating in physical activity as tolerated

Implementing Interventions

When implementing interventions that have been planned to enhance oxygenation, it is always important to assess the client’s current level of dyspnea and modify interventions based on the client’s current status. For example, if dyspnea has worsened, some interventions may no longer be appropriate (such as ambulating), and additional interventions may be needed (such as consulting with a respiratory therapist or administering additional medication).

Evaluation

After implementing interventions, the effectiveness of interventions should be documented, and the overall nursing care plan evaluated. Focused reassessments for evaluating improvement of oxygenation status include analyzing the client's heart rate, respiratory rate, pulse oximetry reading, and lung sounds, in addition to asking the client to rate their level of dyspnea.


8.4 Putting It All Together

OPEN RESOURCES FOR NURSING (OPEN RN)

The following client scenario applies information from this chapter to create an abbreviated nursing care plan and sample documentation note.

Client Scenario

Mr. Smith is an 82-year-old client with a history of chronic obstructive pulmonary disease (COPD). This morning Mr. Smith told the CNA as he was getting ready for breakfast, “I’m feeling weak today and I can’t breathe.” The CNA obtained vital signs and reported them to you: respiratory rate 24, O2 sat 86%, pulse 88, and temperature 36.8 C. View a video simulation of Mr. Smith in the following box.

 View a YouTube¹ of Mr. Smith this morning:



One or more interactive elements has been excluded from this version of the text. You can view them online here: <https://wtcs.pressbooks.pub/nursingfundamentals/?p=290#oembed-1>

Applying the Nursing Process

Assessment: You auscultate Mr. Smith’s breath sounds and find scattered

1. Open RN Project. (2020, March 26). ARISE Simulated Patient Video, Heart Failure Nursing Level 3 – 1027. [Video]. YouTube. CC BY 4.0. <https://www.youtube.com/watch?v=2WFARSE9xs0>

wheezing and rhonchi anteriorly, with diminished breath sounds in the posterior lower lobes. You ask Mr. Smith to rate his shortness of breath now on a scale from 0-10, and he reports it is a “4,” but usually a “2” during activity. While assessing Mr. Smith, you note he is using accessory muscles to breathe and is sitting up in the tripod position. He also has a barrel chest. You quickly check his chart and note the following orders and scheduled medications:

- Tiotropium (Spiriva) inhaler daily
- Fluticasone (Flovent) inhaler daily
- Oxygen via nasal cannula at 1-2 L per minute as needed to maintain O₂ saturation greater than 90%
- Albuterol nebulizer as needed for wheezing

Based on this information, you formulate the following nursing care plan:

Nursing Diagnosis: *Ineffective Breathing Pattern related to respiratory muscle fatigue as manifested by tachypnea and use of accessory muscles to breathe and client stating, “I’m feeling weak today and I can’t breathe.”*

Overall Goal: *The client will have adequate movement of air into and out of the lungs.*

SMART Expected Outcome: *Mr. Smith’s reported level of dyspnea will be within his stated desired range of 1-2 within one hour.*

Planning and Implementing Nursing Interventions:

Interventions	Rationale
1. Implement NIC interventions for <i>Respiratory Monitoring</i> NIC (as described in section 8.3).	Establish a baseline status for today and continue to monitor for improvement or worsening as interventions are implemented.
2. Implement NIC Interventions for <i>Anxiety Reduction</i> (as described in section 8.3).	Dyspnea creates feelings of anxiety. Decreasing the client's anxiety levels will help decrease the feeling of dyspnea.
3. Place client in high Fowler's or tripod position as needed to reduce feelings of dyspnea.	Positioning will assist in maximum expansion of lungs.
4. Apply oxygen via nasal cannula, starting at 1 L/min and titrate until 90% pulse oximetry reading is obtained per standing order.	Oxygen therapy will reduce the work of breathing.
<p>5. Administer scheduled and PRN medications:</p> <ul style="list-style-type: none"> • Albuterol nebulizer • Tiotropium inhaler • Fluticasone inhaler 	<p>Each medication has a different mechanism of action that will assist Mr. Smith's dyspnea.</p> <ul style="list-style-type: none"> • Albuterol is a rapid-acting bronchodilator that will open the airways and improve the amount of oxygen reaching the alveoli with each inhalation. • Tiotropium is a long-acting bronchodilator. • Fluticasone is an inhaled corticosteroid that will reduce inflammation in the airways.
6. Encourage Mr. Smith to use pursed-lip breathing and Huff coughing.	Pursed-lip breathing will help keep the airways open longer on expiration so that more air can then be inhaled on inspiration. Huff coughing will help clear secretions.
7. Encourage fluids (2000 mL/24 hours) and monitor intake and output.	Additional fluids will help thin secretions so they can more easily be coughed up. Mr. Smith does not have fluid restrictions, but it is important to monitor intake/output when encouraging fluids, especially in elderly clients who have increased risk for developing fluid overload.

8. Schedule care activities to allow frequent rest periods.	Resting frequently decreases oxygen demand.
9. Encourage ambulation as tolerated, with the CNA, in the hallway, after the O2 saturation is greater than 90%.	Ambulation will help to mobilize the secretions so they can be removed.

Sample Documentation:

Upon awakening, the client reported a dyspnea level of a “4” and stated, “I’m feeling weak today and I can’t breathe.” Vital signs were respiratory rate 24, O2 sat 86%, pulse 88, and temperature 36.8 C. Scattered wheezing and rhonchi present anteriorly, with diminished breath sounds in the posterior lower lobes. Oxygen applied via nasal cannula at 1 L/min; albuterol nebulizer and scheduled medications were administered. Client was placed in tripod position at edge of bed and encouraged to use pursed-lip breathing and Huff coughing. Post albuterol administration, vital signs were respiratory rate 16, pulse 78, and O2 sat 90% on room air. The wheezing and rhonchi in the anterior lungs were diminished. Client reported dyspnea decreased to a “2” but stated, “I feel less short of breath, but I am still tired.” Encouraged client to push fluids and ambulate as tolerated today, along with frequent rest breaks. Will continue to monitor respiratory rate, pulse, lung sounds, and reported level of dyspnea every four hours today.

Evaluation:

After administering medications and applying the oxygen, you reassess Mr. Smith and find the following: respiratory rate 16, pulse 78, and O2 sat 90% with NC at 1 L/min. The wheezing and rhonchi in the anterior lungs have diminished. You ask Mr. Smith how he is feeling. He rates his current level of dyspnea as a “2” and states, “I feel less short of breath, but I am still tired.” The SMART outcome was “met.” You encourage Mr. Smith to rest after eating breakfast but encourage a walk in the hallway later that morning. You enter the documentation note in the client record.

8.5 Learning Activities

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Activities

(Answers to “Learning Activities” can be found in the “Answer Key” at the end of the book. Answers to interactive activity elements will be provided within the element as immediate feedback.)

1. You are providing care for Mrs. Jones, an 83-year-old female client admitted to the medical-surgical floor with worsening pneumonia. Upon auscultation of the client’s lung fields, you note scattered crackles and diminished breath sounds throughout all lung fields. Mrs. Jones requires 4L O₂ via nasal cannula to maintain an oxygen saturation of 94%. You have constructed a nursing care diagnosis of *Ineffective Breathing Pattern*. What nursing interventions might you consider to help improve the client’s breathing pattern?



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- ▶ Test your knowledge using these [NCLEX Next Generation-style questions](#). You may reset and resubmit your answers to

1. “Oxygenation Flashcards” by [OpenRN](#) is licensed under [CC BY-NC 4.0](#)
2. “Chapter 8 Assignment 1” by Tami Davis for [OpenRN](#) is licensed under [CC BY-NC 4.0](#)

- ▶ the questions in this assignment an unlimited number of times.³

3. “[Chapter 8 Assignment 2](#)” by Rebecca Wicks for [OpenRN](#) is licensed under [CC BY-NC 4.0](#)

VIII Glossary

OPEN RESOURCES FOR NURSING (OPEN RN)

Apnea: Temporary cessation of breathing. When apnea occurs during sleep, it is often caused by the condition called Obstructive Sleep Apnea (OSA).

([Chapter 8.2](#))

Arterial Blood Gas (ABG): Diagnostic test performed on an arterial sample of blood to determine its pH level, oxygenation status, and carbon dioxide status. ([Chapter 8.2](#))

Barrel chest: An increased anterior-posterior chest diameter, resulting from air trapping in the alveoli, that can occur in chronic respiratory diseases like COPD. ([Chapter 8.3](#))

Bradypnea: Decreased respiratory rate less than the normal range according to the client's age. ([Chapter 8.3](#))

Cardiac output: The amount of blood the heart pumps in one minute. ([Chapter 8.2](#))

Clubbing: Enlargement of the fingertips that occurs with chronic hypoxia. ([Chapter 8.3](#))

Coughing and deep breathing: A breathing technique where the client is encouraged to take deep, slow breaths and then exhale slowly. After each set of breaths, the client should cough. This technique is repeated 3 to 5 times every hour. ([Chapter 8.2](#))

Cyanosis: Bluish discoloration of the skin and mucous membranes. ([Chapter 8.2](#))

Dyspnea: A subjective feeling of not getting enough air. Depending on severity, dyspnea causes increased levels of anxiety. ([Chapter 8.2](#))

Endotracheal Tube (ET tube): An ET tube is inserted by an advanced practitioner to maintain a secure airway when a client is experiencing respiratory failure or is receiving general anesthesia. For more information, see the "[Oxygenation Equipment](#)" section of the "Oxygen Therapy" chapter in *Open RN Nursing Skill, 2e.* ([Chapter 8.2](#))

Gas exchange: Refers to the exchange of oxygen and carbon dioxide in the alveoli and the pulmonary capillaries; also called respiration. ([Chapter 8.2](#))

HCO₃⁻: Bicarbonate level of arterial blood indicated in an arterial blood gas (ABG) result. Normal range is 22-26. ([Chapter 8.2](#))

Huffing technique: A technique helpful for clients who have difficulty coughing. Teach the client to inhale with a medium-sized breath and then make a sound like “ha” to push the air out quickly with the mouth slightly open. ([Chapter 8.2](#))

Hypercapnia: Elevated level of carbon dioxide in the blood. ([Chapter 8.2](#))

Hypoxemia: A specific type of hypoxia that is defined as decreased partial pressure of oxygen in the blood (PaO₂) indicated in an arterial blood gas (ABG) result. ([Chapter 8.2](#))

Hypoxia: A reduced level of tissue oxygenation. Hypoxia has many causes, ranging from respiratory and cardiac conditions to anemia. ([Chapter 8.2](#))

Incentive spirometer: A medical device commonly prescribed after surgery to reduce the buildup of fluid in the lungs and to prevent pneumonia. While sitting upright, the client should breathe in slowly and deeply through the tubing with the goal of raising the piston to a specified level. The client 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 client ten times every hour while awake. ([Chapter 8.2](#))

Orthopnea: Difficulty in breathing that occurs when lying down and is relieved upon changing to an upright position. ([Chapter 8.3](#))

PaCO₂: Partial pressure of carbon dioxide level in arterial blood indicated in an ABG result. Normal range is 35-45 mmHg. ([Chapter 8.2](#))

PaO₂: Partial pressure of dissolved oxygen in arterial blood indicated in an ABG result. Normal range is 80-100 mmHg. ([Chapter 8.2](#))

Perfusion: The passage of blood through the arteries to an organ or tissue. ([Chapter 8.2](#))

pH level: A measurement of acidity or alkalinity of the blood in an ABG result. The normal range of pH level for arterial blood is 7.35-7.45. A pH level below 7.35 is considered acidic, causing a condition called acidosis, and a pH level above 7.45 is considered alkaline, causing a condition known as alkalosis. ([Chapter 8.2](#))

Pursed-lip breathing: A breathing technique that encourages a person to inhale through the nose and exhale through the mouth at a slow, controlled flow. ([Chapter 8.2](#))

Purulent sputum: Yellow, green, or brown sputum that often indicates a respiratory infection. ([Chapter 8.3](#))

Respiration: Gas exchange occurring at the alveolar level where blood is oxygenated and carbon dioxide is removed. ([Chapter 8.2](#))

SaO₂: Calculated oxygen saturation level in an ABG result. Normal range is 95-100%. ([Chapter 8.2](#))

Saturation of peripheral oxygen (SpO₂): Hemoglobin saturation level measured by pulse oximetry. Normal range is 94-98%. ([Chapter 8.2](#))

Sputum: Mucus and other secretions that are coughed up and expelled from the mouth. ([Chapter 8.3](#))

Tachypnea: Elevated respiratory rate above normal range according to the client's age. ([Chapter 8.3](#))

Tripod position: A position that enhances air exchange when a client sits up and leans over by resting their arms on their legs or on a bedside table; also referred to as a three-point position. ([Chapter 8.2](#))

Ventilation: Mechanical movement of air into and out of the lungs. ([Chapter 8.2](#))

Vibratory Positive Expiratory Pressure (PEP) Therapy: Handheld devices such as flutter valves or Acapella devices used with clients who need assistance in clearing mucus from their airways. ([Chapter 8.2](#))

PART IX
INFECTION

9.1 Infection Introduction

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Objectives

- Describe risk factors for infection
- Identify cues related to infection across the life span
- Identify practices that reduce the risk of infection transmission
- Identify basic diagnostic tests related to infection
- Differentiate factors related to infection among diverse clients
- Identify industry standards for transmission-based procedures
- Contribute to a plan of care for clients with an infection

Have you ever wondered how nurses can be exposed to clients with communicable diseases day after day and not become ill? There are many factors that affect the body's ability to defend against infection and place some individuals at greater risk of developing an infection. When an infection does occur, early recognition is important to prevent it from spreading within the individual, as well as to others. Protecting people from developing an infection, as well as preventing the spread of infection, is a major concern for nurses. This chapter will discuss the physiology of the inflammation and infectious processes and nursing interventions to prevent the spread of infection.

9.2 Basic Concepts

OPEN RESOURCES FOR NURSING (OPEN RN)

Normal Flora and Microbiome

Microorganisms occur naturally and are present everywhere in our environment. Some microorganisms live on the skin, in the nasopharynx, and in the gastrointestinal tract, but don't become an infection unless the host becomes susceptible. These microorganisms are called **normal flora**. Over the past several years, it has been discovered that every human being carries their own individual suite of microorganisms in and on their body referred to as their **microbiome**. A person's microbiome is acquired at birth and evolves over their lifetime. It is different across body sites and between individuals. A person's gut microbiome has recently been found to impact their immune system.^{1,2}

Pathogens

Microorganisms that cause disease are called **pathogens**. There are four common types of pathogens, including viruses, bacteria, fungi, and parasites.

1. Davis, C. P. Normal flora. (1996). In S. Baron (Ed.), *Medical Microbiology* (4th ed.). University of Texas Medical Branch at Galveston.
<https://www.ncbi.nlm.nih.gov/books/NBK7617/>
2. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

Viruses

Viruses are made up of a piece of genetic code, such as DNA or RNA, and are protected by a coating of protein. After a host (i.e., the person) becomes infected by a virus, the virus invades the body's cells and uses the components of the cell to replicate and produce more viruses. After the virus replication cycle is complete, the new viruses are released into the body, causing damage or destruction of the host's cells.³

Antiviral medications can be used to treat some viral infections. Antibiotics do not kill viruses and are ineffective as a treatment for viral infections. See Figure 9.1⁴ for an image of a virus.

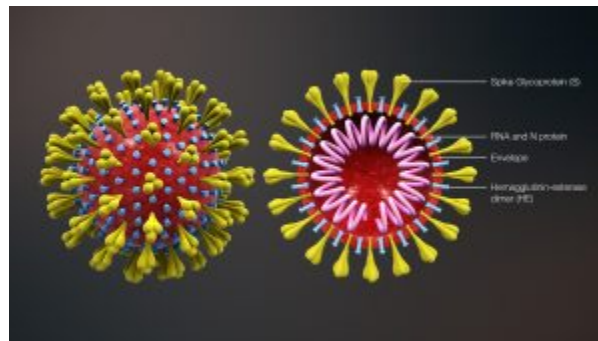


Figure 9.1 Coronavirus

3. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

4. "3D_medical_animation_corona_virus.jpg" by <https://www.scientificanimations.com> is licensed under [CC BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/)

- ▶ Read additional information about antiviral medications in the “[Antivirals](#)” section in the “Antimicrobial” chapter of *Open RN Nursing Pharmacology, 2e*

Bacteria

Bacteria are microorganisms made of a single cell. They are very diverse, have a variety of shapes and features, and have the ability to live in any environment, including your body. However, not all bacteria cause infections. Those that cause infection are called pathogenic bacteria. See Figure 9.2⁵ for an image of a bacterium called *Escherichia coli* (E. coli).

A client is susceptible to bacterial infections when their immune system is compromised by chronic diseases or certain types of medications. Antibiotics are used to treat bacterial infections. However, some strains of bacteria have become resistant to antibiotics, making them difficult to treat. For example, infections caused by *methicillin-resistant Staphylococcus Aureus* (MRSA) are resistant to many types of antibiotics and have the capability of producing severe and life-threatening infections. MRSA infections usually require IV antibiotics and may require treatment for long periods of time.⁶

5. “[E. coli Bacteria_\(16578744517\).jpg](#)” by [NIAID](#) is licensed under [CC BY 2.0](#)

6. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

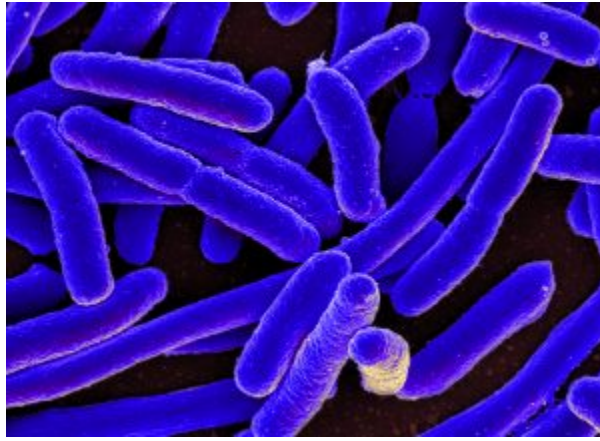


Figure 9.2 *E. coli* Bacteria

- ▶ Read additional information about antibiotics in the “[Antimicrobials](#)” chapter of *Open RN Nursing Pharmacology, 2e*.

Fungi

There are millions of different fungal species on Earth. Fungi can be found everywhere in the environment, including indoors, outdoors, and on human skin, but only about 300 species cause infection when they overgrow.

Candida albicans is a type of fungus that can cause oral thrush and vaginal

yeast infections, especially in susceptible clients or those taking antibiotics.⁷ See Figure 9.3⁸ for an image of oral thrush.

Fungi cells contain a nucleus and other components protected by a membrane and a thick cell wall. This structure can make them harder to kill. Some new strains of fungal infections are proving to be especially dangerous, such as *Candida auris*, which is difficult to diagnose and treat and can cause outbreaks in health care facilities.⁹



Figure 9.3 Oral Thrush

7. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

8. "[Human tongue infected with oral candidiasis.jpg](#)" by James Heilman, MD is licensed under [CC BY-SA 3.0](#)

9. Manoylov, M. K. (2020, November 6). *What are cytokines?* Live Science. <https://www.livescience.com/what-are-cytokines.html>

- ▶ Read additional information about antifungal medications in the “[Antifungals](#)” section of the “Antimicrobials” chapter in *Open RN Nursing Pharmacology, 2e*.

Parasites

Parasites are organisms that behave like tiny animals, living in or on a host, and feeding at the expense of the host. Three main types of parasites can cause disease in humans. These include the following:

- Protozoa: Single-celled organisms that can live and multiply in your body
- Helminths: Multi-celled organisms that can live inside or outside your body and are commonly known as worms
- Ectoparasites: Multi-celled organisms that live on or feed off skin, including ticks and mosquitos

Parasites can be spread several ways, including through contaminated soil, water, food, and blood, as well as through sexual contact and insect bites.¹⁰ See Figure 9.4¹¹ for an image of a helminth infection causing intestinal obstruction in a child. Parasites are treated with a class of medications called antihelmintics.

10. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

11. “[Piece of intestine, blocked by worms \(16424898321\).jpg](#)” by SuSanA Secretariat is licensed under [CC BY 2.0](#)



Figure 9.4 Helminth Infection

- ▶ Read additional information about antihelminthic medications in the “[Antihelmintics](#)” section of the “Antimicrobials” chapter in *Open RN Nursing Pharmacology, 2e*.

9.3 Natural Defenses Against Infection

OPEN RESOURCES FOR NURSING (OPEN RN)

There are two basic ways the body defends against pathogens: nonspecific innate immunity and specific adaptive immunity.

Nonspecific Innate Immunity

Nonspecific innate immunity is a system of defenses in the body that targets invading pathogens in a nonspecific manner. It is called “innate” because it is present from the moment we are born. Nonspecific innate immunity includes physical defenses, chemical defenses, and cellular defenses.¹

Physical Defenses

Physical defenses are the body’s most basic form of defense against infection. They include physical barriers to microbes, such as skin and mucous membranes, as well as mechanical defenses that physically remove microbes and debris from areas of the body where they might cause harm or infection. In addition, a person’s microbiome provides physical protection against disease as normal flora compete with pathogens for nutrients and cellular-binding sites.²

1. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

2. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016).

SKIN

One of the body's most important physical barriers is the skin barrier, which is composed of three layers of closely packed cells. See Figure 9.5³ for an illustration of the layers of skin. The topmost layer of skin called the epidermis consists of cells that are packed with keratin. Keratin makes the skin's surface mechanically tough and resistant to degradation by bacteria. Infections can occur when the skin barrier is broken, allowing the entry of opportunistic pathogens that infect the skin tissue surrounding the wound and possibly spread to deeper tissues.⁴

Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

3. "OSC_Microbio_17_02_Skin.jpg" by OpenStax is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://openstax.org/books/microbiology@9.8/pages/17-1-physical-defenses>.
4. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

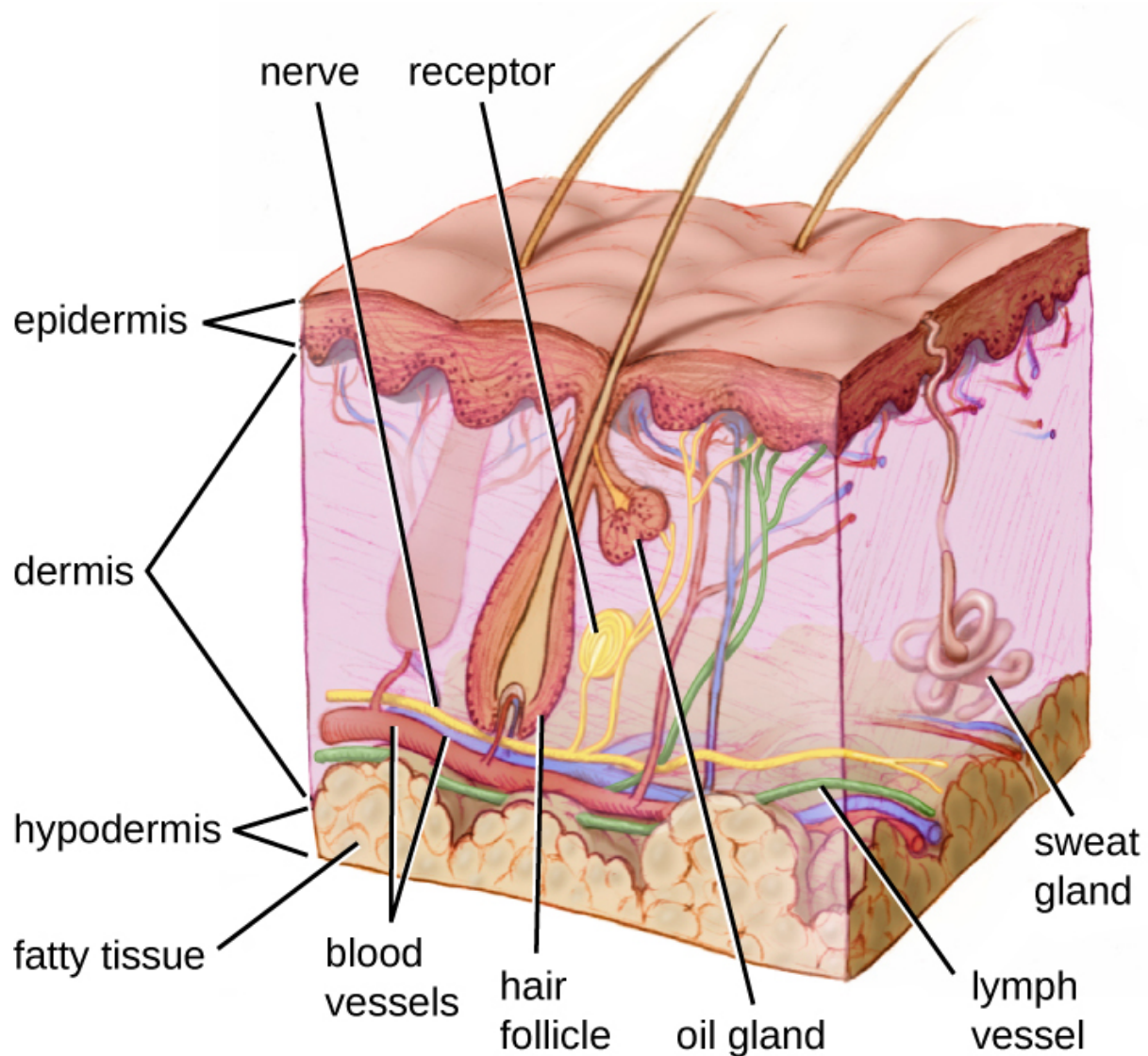


Figure 9.5 Layers of Skin

MUCUS MEMBRANES

The mucous membranes lining the nose, mouth, lungs, and urinary and digestive tracts provide another nonspecific barrier against potential pathogens. Mucous membranes consist of a layer of epithelial cells bound by tight junctions. The epithelial cells secrete a moist, sticky substance called mucous. Mucous covers and protects the fragile cell layers beneath it and also

traps debris, including microbes. Mucus secretions also contain antimicrobial peptides.⁵

In many regions of the body, mechanical actions flush mucus (along with trapped or dead microbes) out of the body or away from potential sites of infection. For example, in the respiratory system, inhalation can bring microbes, dust, mold spores, and other small airborne debris into the body. This debris becomes trapped in the mucus lining the respiratory tract. The epithelial cells lining the upper parts of the respiratory tract have hair-like appendages known as cilia. Movement of the cilia propels debris-laden mucus out and away from the lungs. The expelled mucus is then swallowed and destroyed in the stomach, coughed up, or sneezed out. This system of removal is often called the mucociliary escalator. Disruption of the mucociliary escalator by the damaging effects of smoking can lead to increased colonization of bacteria in the lower respiratory tract and frequent infections, which highlights the importance of this physical barrier to host defenses.⁶ See Figure 9.6⁷ for an image of a magnified mucociliary escalator.

5. The Integrative HMP (iHMP) Research Network Consortium. (2019). Proctor, L. M., Creasy, H. H., et. al. The integrative human microbiome project. *Nature*, 569, 641–648. <https://doi.org/10.1038/s41586-019-1238-8>
6. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>
7. “[Bronchiolar epithelium_3 - SEM.jpg](#)” by Charles Daghlian is licensed by [CC0](#)

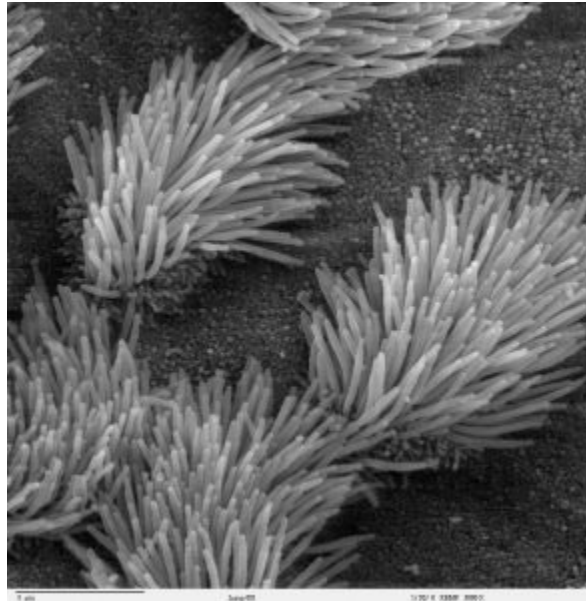


Figure 9.6 Mucociliary Escalator

Like the respiratory tract, the digestive tract is a portal of entry through which microbes enter the body, and the mucous membranes lining the digestive tract provide a nonspecific physical barrier against ingested microbes. The intestinal tract is lined with epithelial cells, interspersed with mucus-secreting goblet cells. This mucus mixes with material received from the stomach, trapping foodborne microbes and debris, and is moved forward through the digestive tract via the mechanical action of peristalsis. **Peristalsis** refers to involuntary contraction and relaxation of the muscles of the intestine, creating wave-like movements that push digested content forward in the digestive tract.⁸ For this reason, feces can contain microorganisms that can cause the spread of infection, making it essential to perform good hand hygiene to prevent transmission of disease through the fecal-oral route.

8. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

ENDOTHELIA

The epithelial cells lining the urogenital tract, blood vessels, lymphatic vessels, and other tissues are known as endothelia. These tightly packed cells provide an effective frontline barrier against invaders. The endothelia of the blood-brain barrier, for example, protects the central nervous system (CNS) from microorganisms. Infection of the CNS can quickly lead to serious and often fatal inflammation. The protection of the blood-brain barrier keeps the cerebrospinal fluid that surrounds the brain and spinal cord sterile.⁹ See Figure 9.7¹⁰ for an illustration of the blood-brain barrier.

9. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

10. "[Protective barriers of the brain.jpg](#)" by Stolp H. B., Liddelow S. A., Sá-Pereira I., Dziegielewska K. M., & Saunders N. R. is licensed under [CC BY-SA 3.0](#)

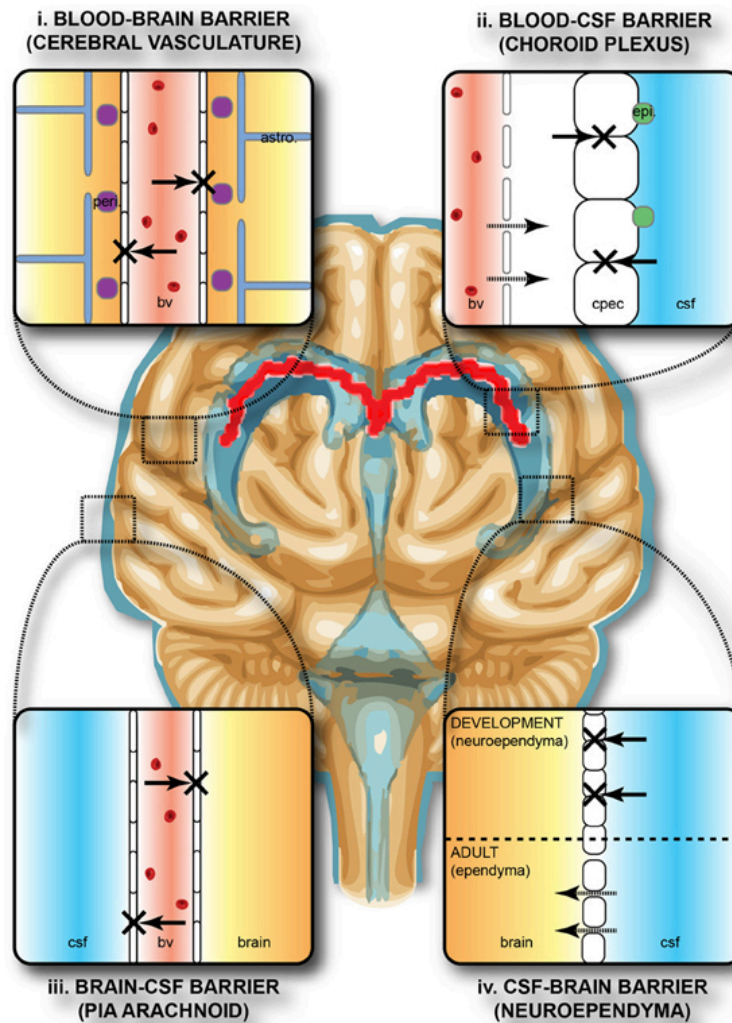


Figure 9.7 Blood-Brain Barrier

Mechanical Defenses

In addition to physical barriers that keep microbes out, the body has several mechanical defenses that physically remove pathogens from the body and prevent them from taking up residence. For example, the flushing action of urine and tears serves to carry microbes away from the body. The flushing action of urine is responsible for the normally sterile environment of the urinary tract. The eyes have additional physical barriers and mechanical mechanisms for preventing infections. The eyelashes and eyelids prevent dust and airborne microorganisms from reaching the surface of the eye. Any microbes or debris that make it past these physical barriers is flushed out by

the mechanical action of blinking, which bathes the eye in tears, washing debris away.¹¹ See Figure 9.8¹² for an image of an infant's eyelashes that prevent dust from reaching the surface of the eye.



Figure 9.8 Eyelashes Are Mechanical Defenses

MICROBIOME

Normal flora that contributes to an individual's microbiome serve as an important first-line defense against invading pathogens. Through their occupation of cellular binding sites and competition for available nutrients, normal flora prevents the early steps of pathogen attachment and proliferation required for the establishment of an infection. For example, in the vagina, normal flora competes with opportunistic pathogens like *Candida albicans*. This competition prevents yeast infection by limiting the availability of nutrients and inhibiting the growth of *Candida*, keeping its population in check. Similar competitions occur between normal flora and potential

11. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

12. "[Eyelashes of a 2-month-old baby boy.png](#)" by Karthik.yerramilly is licensed under [CC BY-SA 4.0](#)

pathogens on the skin, in the upper respiratory tract, and in the gastrointestinal tract.¹³

The importance of the normal flora in host defenses is highlighted by a person's increased susceptibility to infectious diseases when their microbiome is disrupted or eliminated. For example, treatment with antibiotics can significantly deplete the normal flora of the gastrointestinal tract, providing an advantage for pathogenic bacteria such as *Clostridium difficile* (C-diff) to colonize and cause diarrheal infection. Diarrhea caused by C-diff can be severe and potentially lethal. In fact, a recent strategy for treating recurrent C-diff infections is fecal transplantation that involves the transfer of fecal material from a donor into the intestines of the client as a method of restoring their normal flora.¹⁴

Chemical Defenses

In addition to physical defenses, our nonspecific innate immune system uses several chemical mediators that inhibit microbial invaders. The term chemical mediators encompass a wide array of substances found in various fluids and tissues throughout the body. For example, sebaceous glands in the dermis secrete an oil called sebum that is released onto the skin surface through hair follicles. Sebum provides an additional layer of defense by helping seal off the pore of the hair follicle and preventing bacteria on the skin's surface from invading sweat glands and surrounding tissue. Environmental factors can affect these chemical defenses of the skin. For example, low humidity in the winter makes the skin drier and more susceptible to pathogens normally

13. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>
14. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

inhibited by the skin's low pH. Application of skin moisturizer restores moisture and essential oils to the skin and helps prevent dry skin from becoming infected.¹⁵

Examples of other chemical defenses are enzymes, pH level, and chemical mediators. Enzymes in saliva and the digestive tract eliminate most pathogens that manage to survive the acidic environment of the stomach. In the urinary tract, the slight acidity of urine inhibits the growth of potential pathogens in the urinary tract. The respiratory tract also uses various chemical mediators in the nasal passages, trachea, and lungs that have antibacterial properties.¹⁶

PLASMA PROTEIN MEDIATORS

In addition to physical, mechanical, and chemical defenses, there are also nonspecific innate immune factors in plasma, the fluid portion of blood, such as acute-phase proteins, complement proteins, and cytokines. These plasma protein mediators contribute to the inflammatory response.¹⁷

An example of an acute-phase protein is C-reactive protein. High levels of C-

15. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

16. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

17. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

reactive protein indicate inflammation caused by a serious infection or other medical condition.¹⁸

Complement proteins are always present in the blood and tissue fluids, allowing them to be activated quickly. They aid in the destruction of pathogens by piercing their outer membranes (cell lysis) or by making them more attractive to phagocytic cells such as macrophages.¹⁹

Cytokines are proteins that affect interaction and communication between cells. When a pathogen enters the body, the first immune cell to notice the pathogen is like the conductor of an orchestra. That cell directs all the other immune cells by creating and sending out messages (cytokines) to the rest of the organs or cells in the body to respond to and initiate inflammation. Too many cytokines can have a negative effect and result in what's known as a **cytokine storm**.^{20,21} A cytokine storm is a severe immune reaction in which the body releases too many cytokines into the blood too quickly. A cytokine storm can occur as a result of an infection, autoimmune condition, or other disease. Signs and symptoms include high fever, inflammation, severe fatigue, and nausea. A cytokine storm can be severe or life-threatening and lead to

18. Molnar, C., & Gair, J. (2015). *Concepts of Biology – 1st Canadian edition*. BCcampus. Access for free at <https://opentextbc.ca/biology/>
19. Sproston, N. R., & Ashworth, J. J. (2018). Role of c-reactive protein at sites of inflammation and infection. *Frontiers in Immunology*, 9, 754. <https://doi.org/10.3389/fimmu.2018.00754>
20. Complement. (2018). In *Britannica*. <https://www.britannica.com/science/complement-immune-system-component>
21. Arango Duque, G., & Descoteaux, A. (2014). Macrophage cytokines: Involvement in immunity and infectious diseases. *Frontiers in Immunology*, 5, 491. <https://doi.org/10.3389/fimmu.2014.00491>

multiple organ failure. For example, many COVID-19 complications and deaths were caused by a cytokine storm.^{22,23}

Inflammation

Inflammation is a response triggered by a cascade of chemical mediators and occurs when pathogens successfully breach the nonspecific innate immune system or when an injury occurs. Although inflammation is often perceived as a negative consequence of injury or disease, it is a necessary process that recruits cellular defenses needed to eliminate pathogens, remove damaged and dead cells, and initiate repair mechanisms. Excessive inflammation, however, can result in local tissue damage, and in severe cases, such as sepsis, it can become deadly.²⁴

An immediate response to tissue injury is acute inflammation. Vasoconstriction occurs to minimize blood loss if injury has occurred. Vasoconstriction is followed by vasodilation with increased permeability of the blood vessels due to the release of histamine by mast cells. Histamine contributes to the five observable signs of the inflammatory response: erythema (redness), edema (swelling), heat, pain, and altered function. It is also associated with an influx of phagocytes at the site of injury and/or

22. National Cancer Institute (n.d.) *NCI dictionary of cancer terms*.
<https://www.cancer.gov/publications/dictionaries/cancer-terms/def/cytokine-storm>
23. Hojyo, S., Uchida, M., Tanaka, K., et al. (2020). How COVID-19 induces cytokine storm with high mortality. *Inflammation and Regeneration*, 40(37).
<https://doi.org/10.1186/s41232-020-00146-3>
24. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

infection. See Figure 9.9²⁵ for an illustration of the inflammatory response, with (a) demonstrating when mast cells detect injury to nearby cells and release histamine, initiating an inflammatory response and (b) illustrating where histamine increases blood flow to the wound site and the associated increased vascular permeability allows fluid, proteins, phagocytes, and other immune cells to enter infected tissue. These events result in the swelling and reddening of the injured site. The increased blood flow to the injured site causes it to feel warm. Inflammation is also associated with pain due to these events stimulating nerve pain receptors in the tissue. Increasing numbers of neutrophils are then recruited to the area to fight pathogens. As the fight rages on, white blood cells are recruited to the area, and pus forms from the accumulation of neutrophils, dead cells, tissue fluids, and lymph. Typically, after a few days, macrophages clear out this pus.²⁶ During injury, if this nonspecific inflammatory process does not successfully kill the pathogens, infection occurs.

25. “OSC_Microbio_17_06_Erythema.jpg” by OpenStax is licensed under CC BY 4.0. Access for free at <https://openstax.org/books/microbiology/pages/17-5-inflammation-and-fever>.

26. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

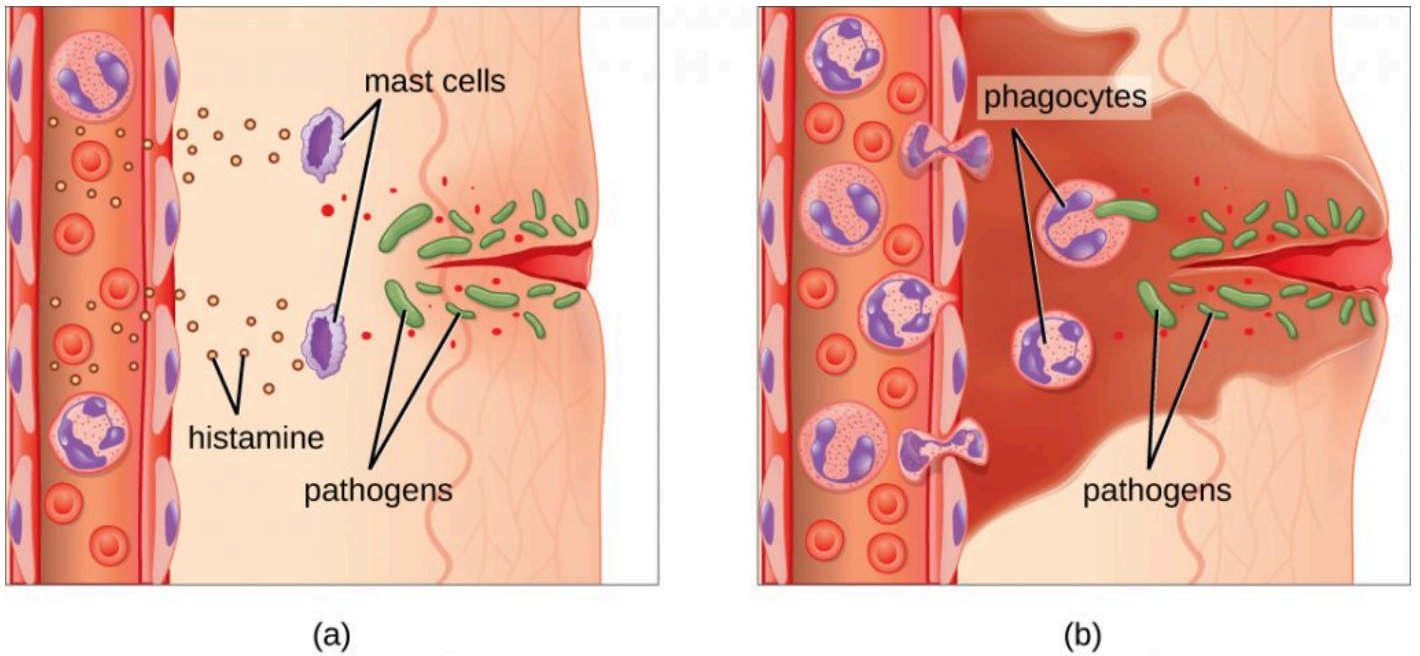


Figure 9.9 Inflammatory Response

Fever

A fever is part of the inflammatory response that extends beyond the site of infection and affects the entire body, resulting in an overall increase in body temperature. Like other forms of inflammation, a fever enhances the nonspecific innate immune defenses by stimulating white blood cells to kill pathogens. The rise in body temperature also inhibits the growth of many pathogens. During fever, the client's skin may appear pale due to vasoconstriction of the blood vessels in the skin to divert blood flow away from extremities, minimize the loss of heat, and raise the body's core temperature. The hypothalamus also stimulates the shivering of muscles to generate heat and raise the core temperature.²⁷

A low-level fever is thought to help an individual overcome an illness.

27. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

However, in some instances, this immune response can be too strong, causing tissue and organ damage and, in severe cases, even death. For example, *Staphylococcus aureus* and *Streptococcus pyogenes* are capable of producing superantigens that cause toxic shock syndrome and scarlet fever, respectively. Both of these conditions are associated with extremely high fevers in excess of 42 °C (108 °F) that must be managed to prevent tissue injury and death.²⁸

When a fever breaks, the hypothalamus stimulates vasodilation, resulting in a return of blood flow to the skin and a subsequent release of heat from the body. The hypothalamus also stimulates sweating, which cools the skin as the sweat evaporates.²⁹

Specific Adaptive Immunity

Now that we have discussed several nonspecific innate defenses against a pathogen, let's discuss specific adaptive immunity. **Specific adaptive immunity** is the immune response that is activated when the nonspecific innate immune response is insufficient to control an infection. There are two types of adaptive responses: the cell-mediated immune response, which is carried out by T cells, and the humoral immune response, which is controlled by activated B cells and antibodies.³⁰

B cells mature in the bone marrow. B cells make Y-shaped proteins called

28. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

29. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

30. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

antibodies that are specific to each pathogen and lock onto its surface and mark it for destruction by other immune cells. The five classes of antibodies are IgG, IgM, IgA, IgD, and IgE. They also turn into memory B cells. Memory B cells are stored and released in the event a specific antigen reappears in the future. This allows the immune system to mount a quick defense because of the previously created memory B cells.³¹

T cells mature in the thymus. T cells are categorized into three classes: helper T cells, regulatory T cells, and cytotoxic T cells. Helper T cells stimulate B cells to make antibodies and help killer cells develop. Killer T cells directly kill cells that have already been infected by a pathogen. T cells also use cytokines as messenger molecules to send chemical instructions to the rest of the immune system to ramp up its response.³²

Specific adaptive immunity also creates memory cells for each specific pathogen that provides the host with long-term protection from reinfection with that pathogen. On reexposure, these memory cells facilitate an efficient and quick immune response. For example, when an individual recovers from chicken pox, the body develops a memory of the *varicella-zoster* virus that will specifically protect it from reinfection if it is exposed to the virus again. Vaccines are administered with the purpose of enhancing a person's specific adaptive immunity.³³

31. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

32. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

33. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

See Figure 9.10³⁴ for an illustration of innate immunity and specific adaptive immunity that occur in response to a pathogen entering the body through the nose.

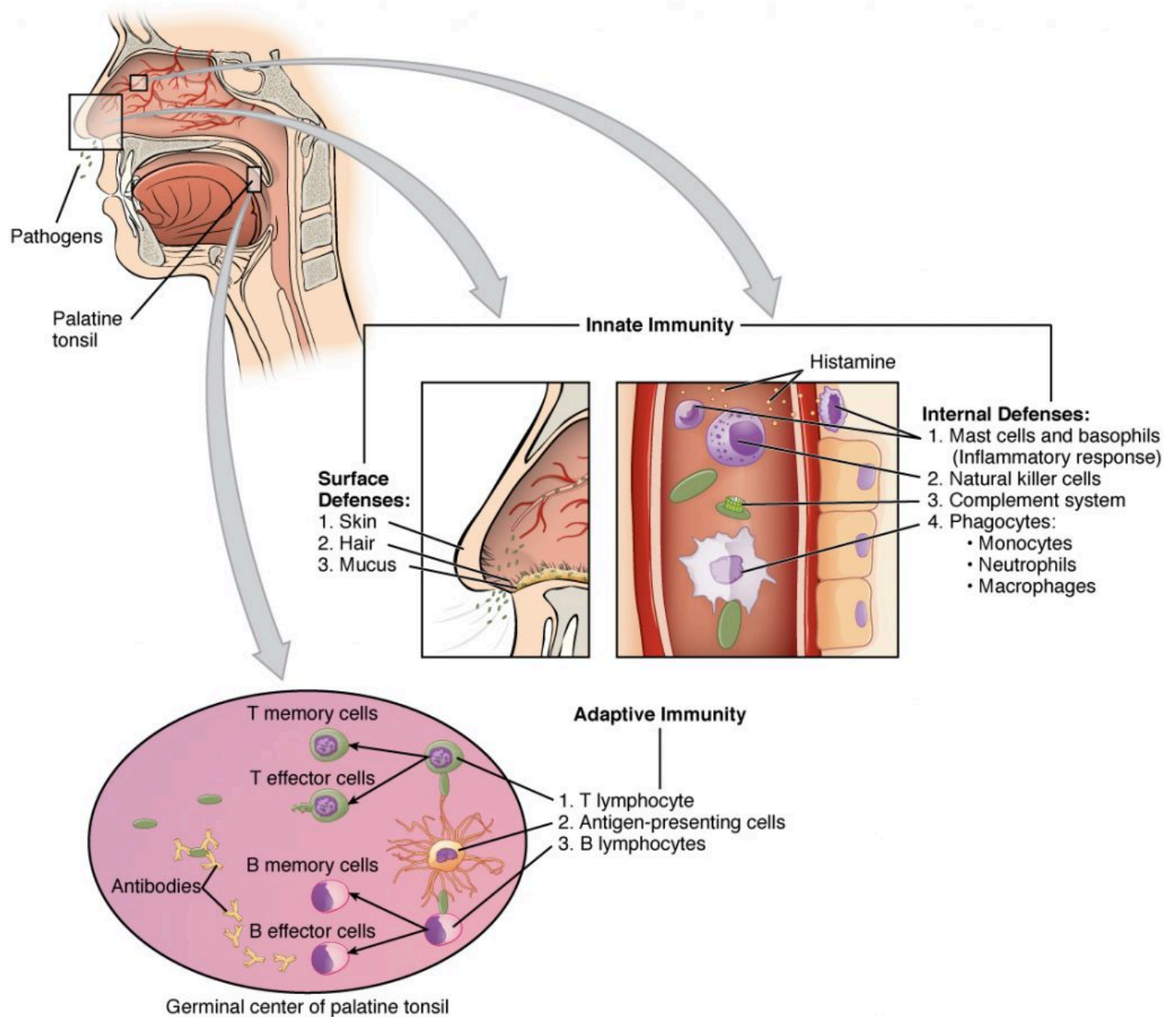


Figure 9.10 Innate Immunity and Specific Adaptive Immunity

34. "2211 Cooperation Between Innate and Immune Responses.jpg" by OpenStax is licensed under CC BY 3.0.

9.4 Infection

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An **infection** is the invasion and growth of a microorganism within the body. Infection can lead to **disease** that causes signs and symptoms, resulting in a deviation from the normal structure or functioning of the host. Infection occurs when nonspecific innate immunity and specific adaptive immunity defenses are inadequate to protect an individual against the invasion of a pathogen. The ability of a microorganism to cause disease is called **pathogenicity**, and the degree to which a microorganism is likely to become a disease is called virulence. **Virulence** is a continuum. On one end of the spectrum are organisms that are not harmful, but on the other end are organisms that are highly virulent. Highly virulent pathogens will almost always lead to a disease state when introduced to the body, and some may even cause multi-organ and body system failure in healthy individuals. Less virulent pathogens may cause an initial infection, but may not always cause severe illness. Pathogens with low virulence usually result in mild signs and symptoms of disease, such as a low-grade fever, headache, or muscle aches, and some individuals may even be asymptomatic.¹

An example of a highly virulent microorganism is *Bacillus anthracis*, the pathogen responsible for anthrax. The most serious form of anthrax is inhalation anthrax. After *Bacillus anthracis* spores are inhaled, they germinate. An active infection develops, and the bacteria release potent toxins that cause edema (fluid buildup in tissues), hypoxia (a condition preventing oxygen from reaching tissues), and necrosis (cell death and inflammation). Signs and symptoms of inhalation anthrax include high fever,

1. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

difficulty breathing, vomiting, coughing up blood, and severe chest pains suggestive of a heart attack. With inhalation anthrax, the toxins and bacteria enter the bloodstream, which can lead to multi-organ failure and death of the client.²

Primary Pathogens Versus Opportunistic Pathogens

Pathogens can be classified as either primary pathogens or opportunistic pathogens. A **primary pathogen** can cause disease in a host regardless of the host's microbiome or immune system. An **opportunistic pathogen**, by contrast, can cause disease only in situations that compromise the host's defenses, such as the body's protective barriers, immune system, or normal microbiome. Individuals susceptible to opportunistic infections include the very young, the elderly, women who are pregnant, clients undergoing chemotherapy, people with immunodeficiencies (such as acquired immunodeficiency syndrome [AIDS]), clients who are recovering from surgery, and those who have nonintact skin (such as a severe wound or burn).³

An example of a primary pathogen is enterohemorrhagic *Escherichia coli* (*E. coli*) that produces a toxin that leads to severe and bloody diarrhea, inflammation, and renal failure, even in clients with healthy immune systems. *Staphylococcus epidermidis*, on the other hand, is an opportunistic pathogen that is a frequent cause of healthcare acquired infection. *Staphylococcus epidermidis*, often referred to as "staph," is a member of the normal flora of the skin. However, in hospitals, it can grow in biofilms that form on catheters, implants, or other devices that are inserted into the body during surgical

2. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>
3. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

procedures. Once inside the body, it can cause serious infections such as endocarditis.⁴

Other members of normal flora can cause opportunistic infections. Some microorganisms that reside harmlessly in one location of the body can cause disease if they are passed to a different body system. For example, *E. coli* is normally found in the large intestine, but can cause a urinary tract infection if it enters the bladder.⁵

Normal flora can also cause disease when a shift in the environment of the body leads to overgrowth of a particular microorganism. For example, the yeast *Candida* is part of the normal flora of the skin, mouth, intestine, and vagina, but its population is kept in check by other organisms of the microbiome. When an individual takes antibiotics, bacteria that would normally inhibit the growth of *Candida* can be killed off, leading to a sudden growth in the population of *Candida*. An overgrowth of *Candida* can manifest as oral thrush (growth of yeast on mouth, throat, and tongue) or a vaginal yeast infection. Other scenarios can also provide opportunities for *Candida* to cause infection. For example, untreated diabetes can result in a high concentration of glucose in a client's saliva that provides an optimal environment for the growth of *Candida*, resulting in oral thrush. Immunodeficiencies, such as those seen in clients with HIV, AIDS, and cancer, can also lead to *Candida* infections because the body's immune system is weakened in these conditions and unable to fight off the *Candida*.⁶

4. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

5. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

6. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

Stages of Pathogenesis

To cause disease, a pathogen must successfully achieve four stages of pathogenesis to become an infection: exposure, adhesion (also called colonization), invasion, and infection. The pathogen must be able to gain entry to the host, travel to the location where it can establish an infection, evade or overcome the host's immune response, and cause damage (i.e., disease) to the host. In many cases, the cycle is completed when the pathogen exits the host and is transmitted to a new host.⁷

Exposure

An encounter with a potential pathogen is known as **exposure**. The food we eat and the objects we touch are all ways that we can come into contact with potential pathogens. Yet, not all contacts result in infection and disease. For a pathogen to cause disease, it needs to be able to gain access into host tissue. An anatomic site through which pathogens can pass into host tissue is called a **portal of entry**. Portals of entry are locations where the host cells are in direct contact with the external environment, such as the skin, mucous membranes, respiratory, and digestive systems. Portals of entry are illustrated in Figure 9.11.^{8,9}

7. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>
8. "OSC_Microbio_15_02_Portal.jpg" by OpenStax is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>.
9. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). *Microbiology*. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

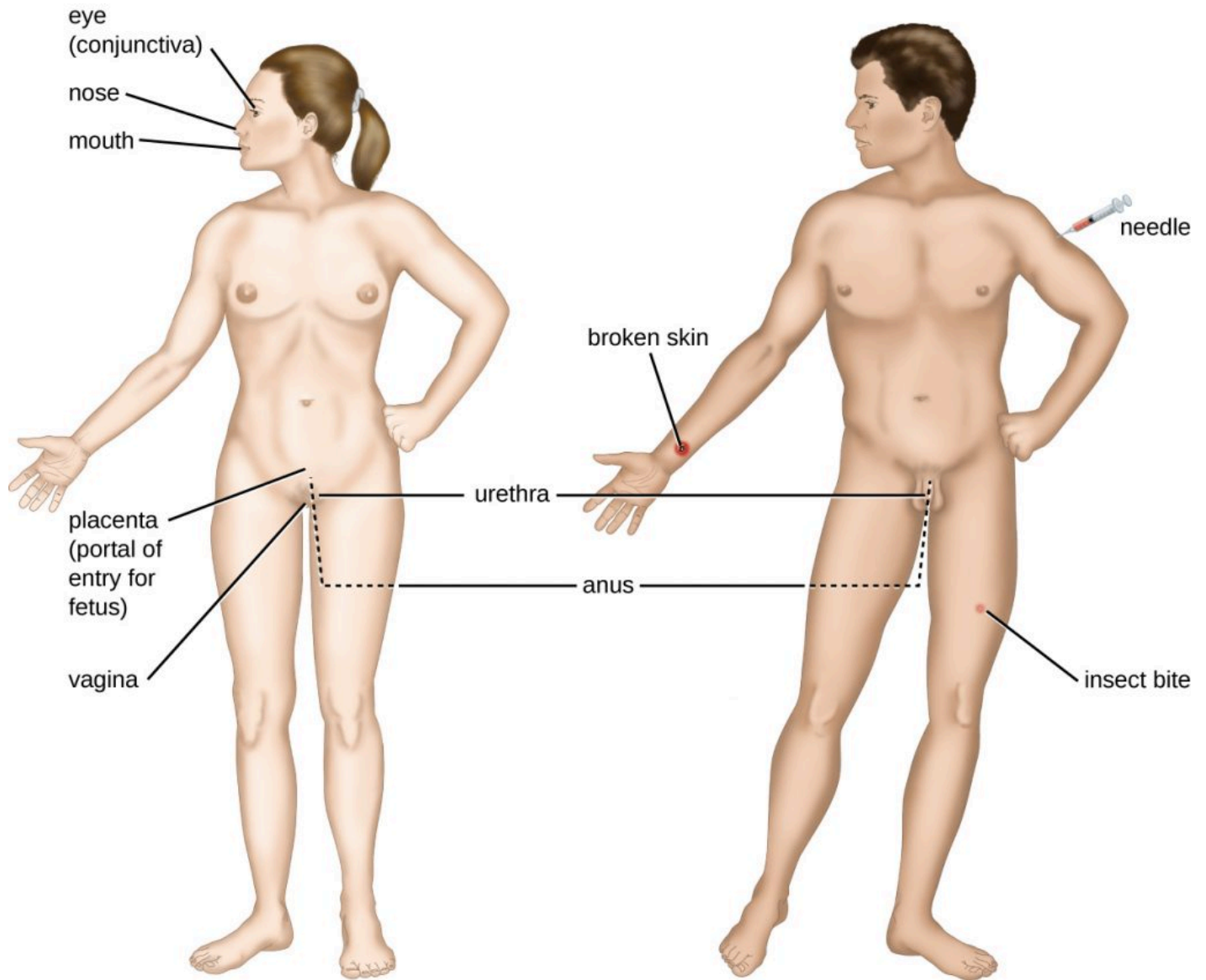


Figure 9.11 Sites of Portal of Entry

Adhesion

Following initial exposure, the pathogen adheres at the portal of entry. The term **adhesion** refers to the capability of pathogenic microbes to attach to the cells of the body, also referred to as colonization.¹⁰

10. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016).

Invasion

After successful adhesion, the invasion proceeds. **Invasion** means the spread of a pathogen throughout local tissues or the body. Pathogens may also produce virulence factors that protect them against immune system defenses and determine the degree of tissue damage that occurs. Intracellular pathogens like viruses achieve invasion by entering the host's cells and reproducing.¹¹

Infection

Following invasion, successful multiplication of the pathogen leads to infection. Infections can be described as local, secondary, or systemic, depending on the extent of the infection.¹²

A **local infection** is confined to a small area of the body, typically near the portal of entry. For example, a hair follicle infected by *Staphylococcus aureus* infection may result in a boil around the site of infection, but the bacterium is largely contained to this small location. Other examples of local infections that involve more extensive tissue involvement include urinary tract infections confined to the bladder or pneumonia confined to the lungs. Localized infections generally demonstrate signs of inflammation, such as redness,

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12. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). [Microbiology](https://openstax.org/books/microbiology/pages/1-introduction). OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

swelling, warmth, pain, and purulent drainage. However, extensive tissue involvement can also cause decreased functioning of the organ affected.¹³

A **secondary infection** is an infection that occurs during or after treatment for a different infection. It may be caused by the treatment for the first infection or a result of a diminished immune system or the elimination of normal flora. For example, a yeast infection that occurs after a client is treated with antibiotics is a secondary infection.¹⁴

When an infection becomes disseminated throughout the body, it is called a **systemic infection**. For example, infection by the *varicella-zoster* virus typically gains entry through a mucous membrane of the upper respiratory system. It then spreads throughout the body, resulting in a classic red rash associated with chicken pox. Because these lesions are not sites of initial infection, they are signs of a systemic infection. Systemic infections can cause fever, increased heart and respiratory rates, lethargy, malaise, anorexia, and tenderness and enlargement of the lymph nodes.¹⁵

Sometimes a primary infection can lead to a secondary infection by an opportunistic pathogen. For example, when a client experiences a primary infection from influenza, it can damage and decrease the defense mechanisms of the lungs, making the client more susceptible to a secondary pneumonia by a bacterial pathogen like *Haemophilus influenzae*. Additionally, treatment of the primary infection may lead to a secondary infection caused by an opportunistic pathogen. For example, antibiotic therapy targeting the primary infection alters the normal flora and creates an

13. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

14. U.S. National Library of Medicine. (2024). Secondary infections. Medline Plus. <https://medlineplus.gov/ency/article/002300.htm>

15. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

opening for opportunistic pathogens like *Clostridium difficile* or *Candida Albicans* to cause a secondary infection.¹⁶

Bacteremia, SIRS, Sepsis, and Septic Shock

When infection occurs, pathogens can enter the bloodstream. The presence of bacteria in blood is called **bacteremia**. If bacteria are both present and multiplying in the blood, it is called **septicemia**.¹⁷

Systemic inflammatory response syndrome (SIRS) is an exaggerated inflammatory response that affects the entire body. It is the body's reaction to a noxious stressor, including causes such as infection and acute inflammation, but other conditions can trigger it as well. Signs of SIRS are as follows:

- Body temperature over 38 or under 36 degrees Celsius
- Heart rate greater than 90 beats/minute
- Respiratory rate greater than 20 breaths/minute or PaCO₂ less than 32 mmHg
- White blood cell count greater than 12,000 or less than 4,000 /microliters or over 10% of immature forms (bands)¹⁸

Even though the purpose of SIRS is to defend against a noxious stressor, the

16. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

17. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

18. Mouton, C. P., Bazaldua, O., Pierce, B., & Espino, D. V. (2001). Common infections in older adults. *American Family Physician*, 63(2), 257-269. <https://www.aafp.org/afp/2001/0115/p257.html>

uncontrolled release of massive amounts of cytokines, called cytokine storm, can lead to organ dysfunction and even death.¹⁹

Sepsis refers to SIRS that is caused by an infection. Sepsis occurs when an existing infection triggers an exaggerated inflammatory reaction throughout the body. If left untreated, sepsis causes tissue and organ damage. It can quickly spread to multiple organs and is a life-threatening medical emergency.

Sepsis causing damage to one or more organs (such as the kidneys) is called severe sepsis. Severe sepsis can lead to septic shock, a life-threatening decrease in blood pressure (systolic pressure <90 mm Hg) that prevents cells and other organs from receiving enough oxygen and nutrients, causing multi-organ failure and death. See Figure 9.12²⁰ for an illustration of the progression of sepsis from SIRS to **septic shock**.

Unfortunately, almost any type of infection in any individual can lead to sepsis. Infections that lead to sepsis most often start in the lungs, urinary tract, gastrointestinal tract, or skin. Some people are especially at risk for developing sepsis, such as adults over age 65; children younger than one year old; people who are immunocompromised or have chronic medical conditions, such as diabetes, lung disease, cancer, and kidney disease; and survivors of a previous sepsis episode.²¹

In addition to exhibiting signs of SIRS, clients with sepsis may also have additional signs such as elevated fever and shivering, confusion, shortness of breath, pain or discomfort, and clammy or sweaty skin. Diligent nursing care is vital for recognizing early signs of SIRS and sepsis and promptly notifying

19. Mouton, C. P., Bazaldua, O., Pierce, B., & Espino, D. V. (2001). Common infections in older adults. *American Family Physician*, 63(2), 257-269. <https://www.aafp.org/afp/2001/0115/p257.html>

20. This work is derivative of "[Sepsis_Steps.png](#)" by Hadroncastle and is licensed under [CC BY-SA 4.0](#)

21. Centers for Disease Control and Prevention. (2024). *Sepsis*. <https://www.cdc.gov/sepsis/index.html>

the health care provider and/or following sepsis protocols in place at your health care facility.²²

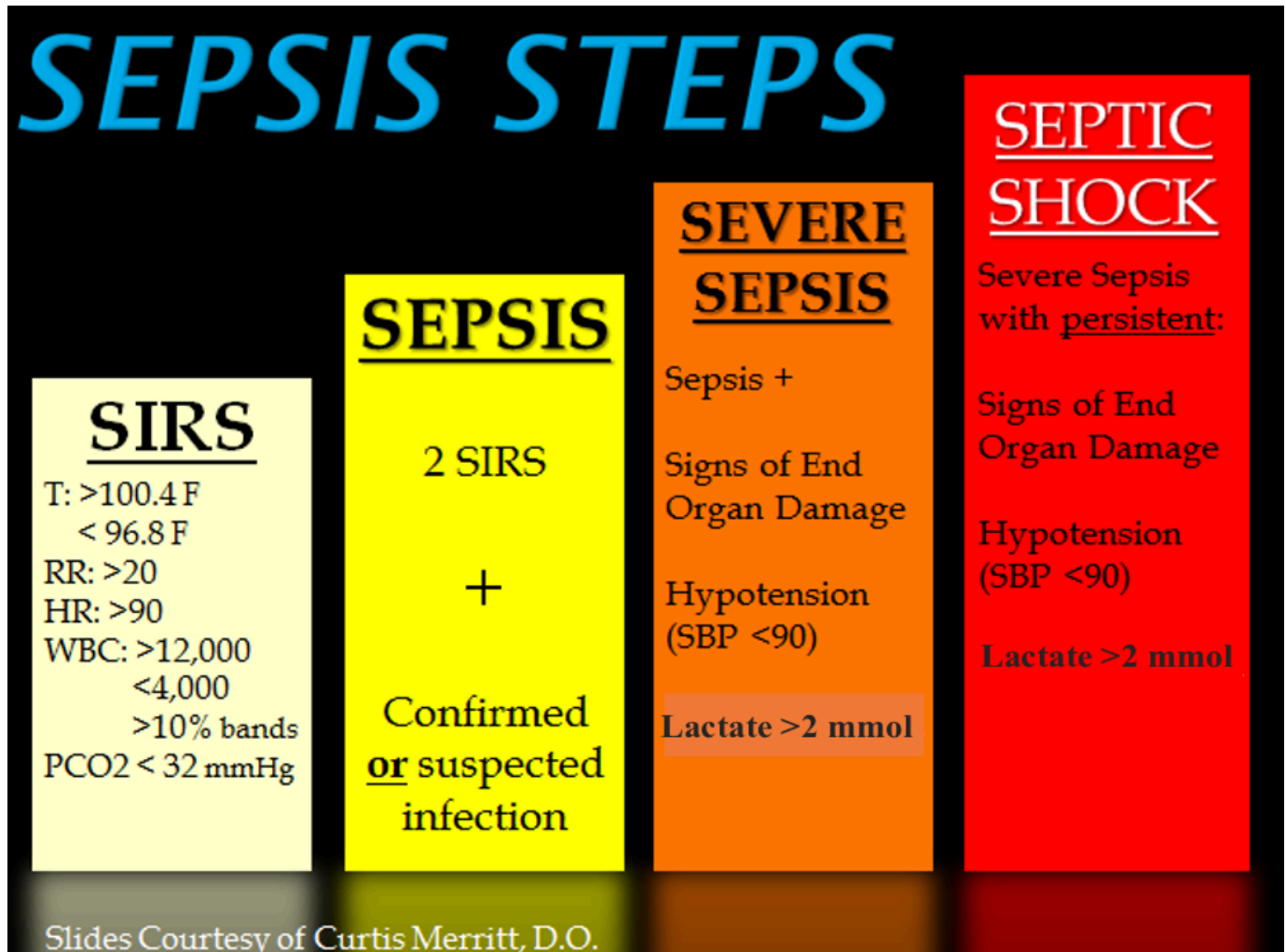


Figure 9.12 Progression of Sepsis

22. Centers for Disease Control and Prevention. (2024). Sepsis. <https://www.cdc.gov/sepsis/index.html>

- ▶ Use the following to read more information about sepsis:
 - Read more information about sepsis at the CDC's [Sepsis](#) web page.
 - Read the CDC infographic on [Protect Your Patients From Sepsis](#).
 - Read an article about caring for clients with sepsis titled [Something Isn't Right: The Subtle Changes of Early Deterioration](#).
 - Read more about the Surviving Sepsis Campaign with early recognition and treatment of sepsis using the [Hour-1 Bundle](#).

Toxins

Some pathogens release toxins that are biological poisons that assist in their ability to invade and cause damage to tissues. For example, *Botulinum toxin* is a neurotoxin produced by the gram-positive bacterium *Clostridium botulinum* that is an acutely toxic substance because it blocks the release of the neurotransmitter acetylcholine. The toxin's blockage of acetylcholine results in muscle paralysis with the potential to stop breathing due to its effect on the respiratory muscles. This condition is referred to as botulism, a type of food poisoning that can be caused by improper sterilization of canned foods. However, because of its paralytic action, low concentrations of Botox are also used for beneficial purposes such as cosmetic procedures to remove wrinkles and in the medical treatment of overactive bladder.²³

23. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

Another type of neurotoxin is tetanus toxin, which is produced by the gram-positive bacterium *Clostridium tetani*. Tetanus toxin inhibits the release of GABA, resulting in permanent muscle contraction. The first symptom of tetanus is typically stiffness of the jaw. Violent muscle spasms in other parts of the body follow, typically culminating with respiratory failure and death. Because of the severity of tetanus, it is important for nurses to encourage individuals to regularly receive tetanus vaccination boosters throughout their lifetimes.²⁴

Stages of Disease

When a pathogen becomes an infection-causing disease, there are five stages of disease, including the incubation, prodromal, illness, decline, and convalescence periods. See Figure 9.13²⁵ for an illustration of the stages of disease.

24. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

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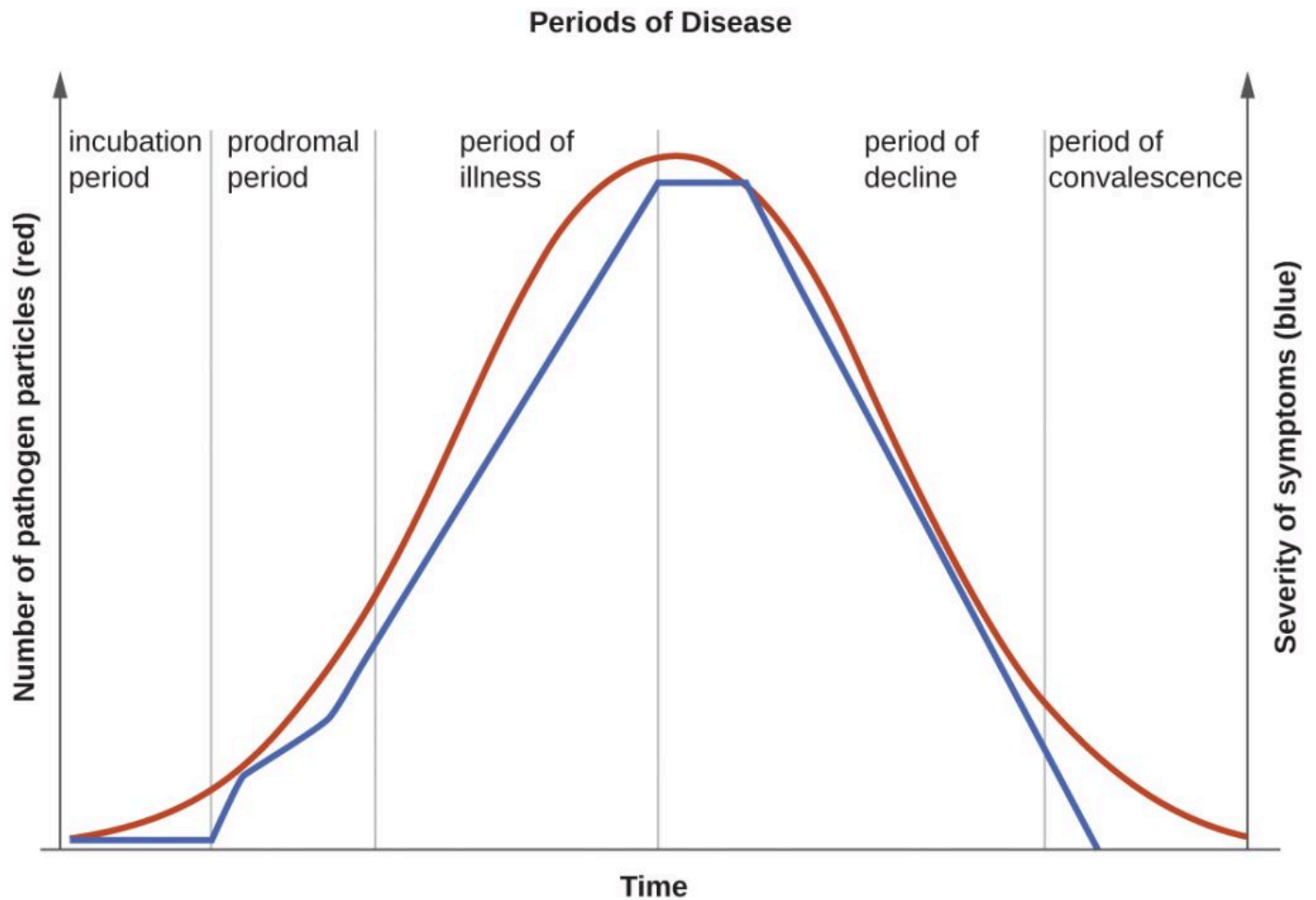


Figure 9.13 Progression of Infectious Disease

Incubation Period

The **incubation period** occurs after the initial entry of the pathogen into the host when it begins to multiply, but there are insufficient numbers of the pathogen present to cause signs and symptoms of disease. Incubation periods can vary from a day or two in acute disease to months or years in chronic disease, depending upon the pathogen. Factors involved in determining the length of the incubation period are diverse and can include virulence of the pathogen, strength of the host immune defenses, site of infection, and the amount of the pathogen received during exposure. During

this incubation period, the client is unaware that a disease is beginning to develop.²⁶

Prodromal Period

The **prodromal period** occurs after the incubation period. During this phase, the pathogen continues to multiply, and the host begins to experience general signs and symptoms of illness caused from activation of the nonspecific innate immunity, such as not feeling well (malaise), low-grade fever, pain, swelling, or inflammation. These signs and symptoms are often too general to indicate a particular disease is occurring.²⁷

Acute Phase

Following the prodromal period is the period of acute illness, during which the signs and symptoms of a specific disease become obvious and can become severe. This period of acute illness is followed by the period of decline as the immune system overcomes the pathogen. The number of pathogen particles begins to decline and thus the signs and symptoms of illness begin to decrease. However, during the decline period, clients may become susceptible to developing secondary infections because their immune systems have been weakened by the primary infection.²⁸

26. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>
27. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>
28. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016).

Convalescent Period

The final period of disease is known as the **convalescent period**. During this stage, the client generally returns to normal daily functioning, although some diseases may inflict permanent damage that the body cannot fully repair.²⁹ For example, if a strep infection becomes systemic and causes a secondary infection of the client's heart valves, the heart valves may never return to full function and heart failure may develop.

Infectious diseases can be contagious during all five of the periods of disease. The transmissibility of an infection during these periods depends upon the pathogen and the mechanisms by which the disease develops and progresses. For example, with many viral diseases associated with rashes (e.g., chicken pox, measles, rubella, roseola), clients are contagious during the incubation period up to a week before the rash develops. In contrast, with many respiratory infections (e.g., colds, influenza, diphtheria, strep throat, and pertussis) the client becomes contagious with the onset of the prodromal period. Depending upon the pathogen, the disease, and the individual infected, transmission can still occur during the periods of decline, convalescence, and even long after signs and symptoms of the disease disappear. For example, an individual recovering from a diarrheal disease may continue to carry and shed the pathogen in feces for a long time, posing a risk of transmission to others through direct or indirect contact.³⁰

Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

29. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

30. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

Types of Infection

Acute vs. Chronic

Acute, self-limiting infections develop rapidly and generally last only 10-14 days. Colds and ear infections are considered acute, self-limiting infections. See Figure 9.14³¹ for an image of an individual with an acute, self-limiting infection. Conversely, **chronic infections** may persist for months. Hepatitis and mononucleosis are examples of chronic infections.³²



Figure 9.14 Acute Infection

Healthcare-Associated Infections

An infection that is contracted in a health care facility or under medical care is

31. “392131387-huge.jpg” by [Alexandr Litovchenko](#) is used under license from [Shutterstock.com](#)

32. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

known as a **healthcare-associated infection (HAI)**, formerly referred to as a nosocomial infection. On any given day, about 1 in 31 hospital clients has at least one healthcare-associated infection. HAIs increase the cost of care and delay recovery and are associated with permanent disability, loss of wages, and even death.^{33,34}

The U.S. Department of Health and Human Services (HHS) has established these goals to reduce these common healthcare-associated infections in health care institutions:

- Reduce central line-associated bloodstream infections (CLABSI)
- Reduce catheter-associated urinary tracts infections (CAUTI)
- Reduce the incidence of invasive health care-associated *Methicillin-resistant Staphylococcus aureus* (MRSA)
- Reduce hospital-onset MRSA bloodstream infections
- Reduce hospital-onset *Clostridium difficile* infections
- Reduce the rate of *Clostridium difficile* hospitalizations
- Reduce surgical site infections (SSI)^{35,36}

33. Centers for Disease Control and Prevention. (2024). *Healthcare-associated infections*. <https://www.cdc.gov/hai/index.html>

34. U.S. Department of Health and Human Services. (2020). *Healthcare-associated infections*. <https://health.gov/our-work/health-care-quality/health-care-associated-infections>

35. Centers for Disease Control and Prevention. (2024). *Healthcare-associated infections*. <https://www.cdc.gov/hai/index.html>

36. U.S. Department of Health and Human Services. (2020). *Healthcare-associated infections*. <https://health.gov/our-work/health-care-quality/health-care-associated-infections>

▶ Read more about [Healthcare-Associated Infections](#).

Blood-borne Pathogens

Blood-borne pathogens are potentially present in a client's blood and body fluids, placing other clients and health care providers at risk for infection if they are exposed. The most common blood-borne pathogens include hepatitis B, hepatitis C, and human immunodeficiency virus (HIV).

When a nurse or other health care worker experiences exposure due to a needlestick injury or the splashing of body fluids, it should be immediately washed or flushed and then reported so that careful monitoring can occur. When the source of the exposure is known, the health care worker and client are initially tested. Repeat testing and medical prophylaxis may be warranted for the health care worker, depending on the results.³⁷

Needlesticks and sharps injuries are the most common causes of blood-borne pathogen exposure for nurses. The National Institute for Occupational Safety and Health (NIOSH) has developed a comprehensive Sharps Injury Prevention Program to decrease needle and sharps injury in health care workers.³⁸

Needles are also used in the community, such as at home, work, airports, or public restrooms as individuals use needles to administer prescribed medications or to inject illegal drugs. Nurses can help prevent needlestick and sharps injuries in their community by implementing a community needle disposal program.

37. Centers for Disease Control and Prevention. (2014). *Bloodborne pathogen exposure*. <https://www.cdc.gov/niosh/docs/2007-157/default.html>

38. Centers for Disease Control and Prevention. (2014). *How to prevent needlestick and sharps injuries*. <https://www.cdc.gov/niosh/docs/2012-123/>

▶ Read more about needlestick and sharps injury prevention in the “[Aseptic Technique](#)” chapter in *Open RN Nursing Skills, 2e*.

9.5 Treating Infection

OPEN RESOURCES FOR NURSING (OPEN RN)

Antibiotics are used to treat bacterial infections. They either kill bacteria or stop them from reproducing, allowing the body's natural defenses to eliminate the pathogens. Used properly, antibiotics can save lives. However, growing antibiotic resistance is curbing the effectiveness of these drugs. Taking an antibiotic as directed, even after symptoms disappear, is key to curing an infection and preventing the development of resistant bacteria.

Antibiotics do not work against viral infections such as colds or influenza. Antiviral drugs, which fight infection either by inhibiting a virus's ability to reproduce or by strengthening the body's immune response to the infection, are used for some viral infections. There are several different classes of drugs in the antiviral family, and each is used for specific kinds of viral infections.

Antifungal medications are used to treat fungal and yeast infections. Antiparasitic medication is used to treat parasites, and anthelmintic medication is used to treat worm infections.

▶ Read more about antibiotic, antiviral, antifungal, and antihelminthic medication in the "[Antimicrobials](#)" chapter in *Open RN Nursing Pharmacology, 2e*.

Antibiotic Stewardship

Microorganisms can quickly develop new features that make them resistant to the drugs that were once able to kill them. People infected with antibiotic-resistant organisms are more likely to have longer, more expensive hospital stays and may be more likely to die as a result of an infection.¹

1. Centers for Disease Control and Prevention. (2024). *Core elements of antibiotic stewardship*. <https://www.cdc.gov/antibiotic-use/hcp/core->

Misuse of antimicrobials is one of the world's most pressing public health problems because of these consequences. Many factors contribute to resistance, including overprescription of antibiotics for nonbacterial infections, use of inappropriate antibiotics for the infectious microorganism, and lack of completion of prescribed antibiotic therapy. Some infections, such as *Methicillin-resistant Staphylococcus aureus* (MRSA) and *Vancomycin-resistant Enterococci* (VRE), are becoming increasingly hard to treat and some microorganisms cannot be effectively destroyed by any known antibiotic.²

Antimicrobial stewardship is a coordinated program that promotes the appropriate use of antimicrobials (including antibiotics), improves client outcomes, reduces microbial resistance, and decreases the spread of infections caused by multidrug-resistant organisms. The Centers for Disease Control (CDC) has developed core elements for antibiotic stewardship to serve as a guide to improve antibiotic use for improved client safety and outcomes.³ See Figure 9.15⁴ for an image from the CDC explaining antibiotic resistance.

[elements/?CDC_AAref_Val=https://www.cdc.gov/antibiotic-use/core-elements/index.html](https://www.cdc.gov/antibiotic-use/core-elements/index.html)

2. Centers for Disease Control and Prevention. (2024). *Core elements of antibiotic stewardship*. https://www.cdc.gov/antibiotic-use/hcp/core-elements/?CDC_AAref_Val=https://www.cdc.gov/antibiotic-use/core-elements/index.html
3. Centers for Disease Control and Prevention. (2024). *Core elements of antibiotic stewardship*. https://www.cdc.gov/antibiotic-use/hcp/core-elements/?CDC_AAref_Val=https://www.cdc.gov/antibiotic-use/core-elements/index.html
4. "HowAntibioticResistanceHappens.jpg" by [CDC](#) is licensed under [CC0](#). Access for free at <https://www.cdc.gov/antibiotic-use/community/materials-references/graphics.html>.

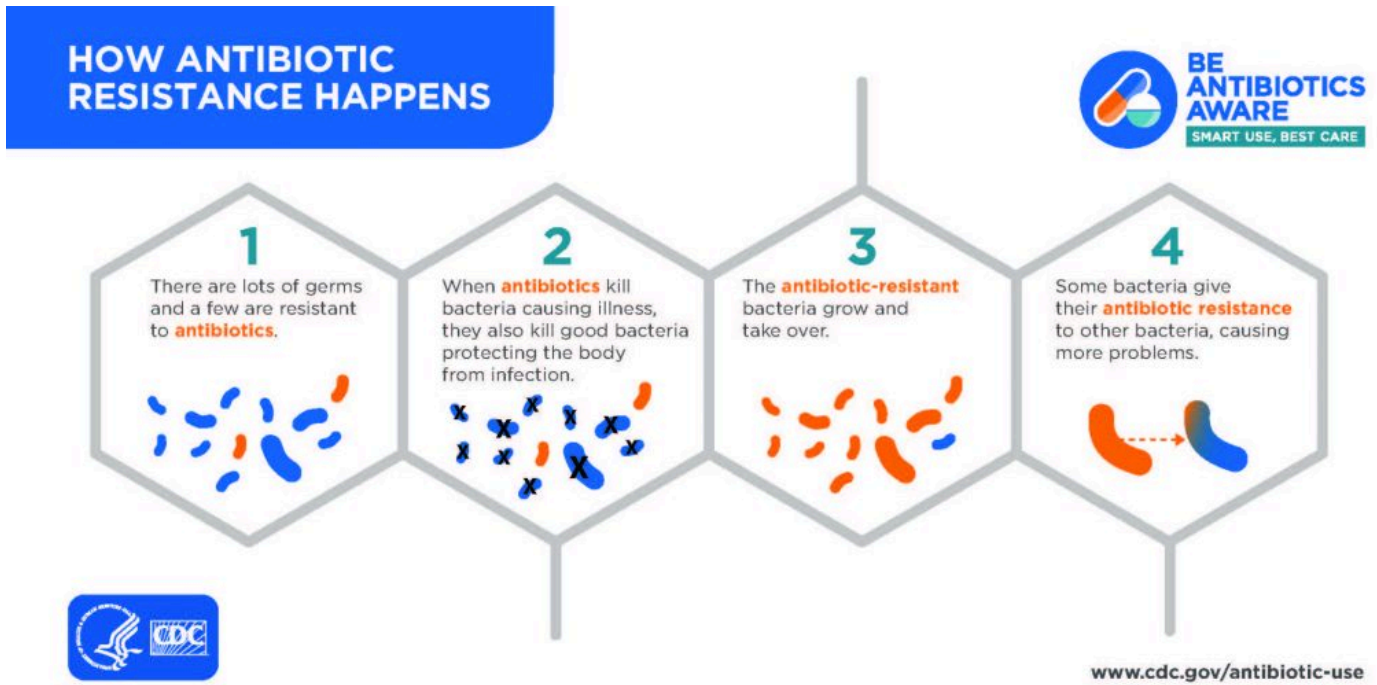


Figure 9.15 Antibiotic Resistance

The nurse plays an important role in antimicrobial stewardship through client education. For example, many clients expect to receive an antibiotic prescription when they seek treatment for an illness or symptom. However, because antibiotics are only effective in treating bacteria, the client should be educated regarding effective treatment for the type of pathogen causing their symptoms. If an antibiotic is prescribed, clients should be advised to complete the entire course of therapy or contact their provider if they are unable to do so. For example, clients often feel better after a few days of treatment and decide not to take the remaining medication, or they may experience side effects from the antibiotic (such as nausea and diarrhea) and stop taking the medication. All of these behaviors can lead to antibiotic resistance and should be addressed when providing client education regarding prescribed antibiotic therapy.

9.6 Preventing Infection

OPEN RESOURCES FOR NURSING (OPEN RN)

In addition to recognizing signs of infection and educating clients about the treatment of their infection, nurses also play an important role in preventing the spread of infection. A cyclic process known as the chain of infection describes the transmission of an infection. By implementing interventions to break one or more links in the chain of infection, the spread of infection can be stopped. See Figure 9.16¹ for an illustration of the links within the chain of infection. These links are described as the following²:

- **Infectious Agent:** A causative organism, such as bacteria, virus, fungi, parasite.
- **Reservoir:** A place where the organism grows, such as in blood, food, or a wound.
- **Portal of Exit:** The method by which the organism leaves the reservoir, such as through respiratory secretions, blood, urine, breast milk, or feces.
- **Mode of Transmission:** The vehicle by which the organism is transferred such as physical contact, inhalation, or injection. The most common vehicles are respiratory secretions spread by a cough, sneeze, or on the hands. A single sneeze can send thousands of virus particles into the air.
- **Portal of Entry:** The method by which the organism enters a new host, such as through mucous membranes or nonintact skin.
- **Susceptible Host:** The susceptible individual the organism has invaded.

1. "[Chain_of_Infection.png](#)" by Genieieiop is licensed under [CC BY-SA 4.0](#)

2. Centers for Disease Control and Prevention. (2022). *Chain of infection components*. <https://www.cdc.gov/niosh/learning/safetyculturehc/module-2/3.html>

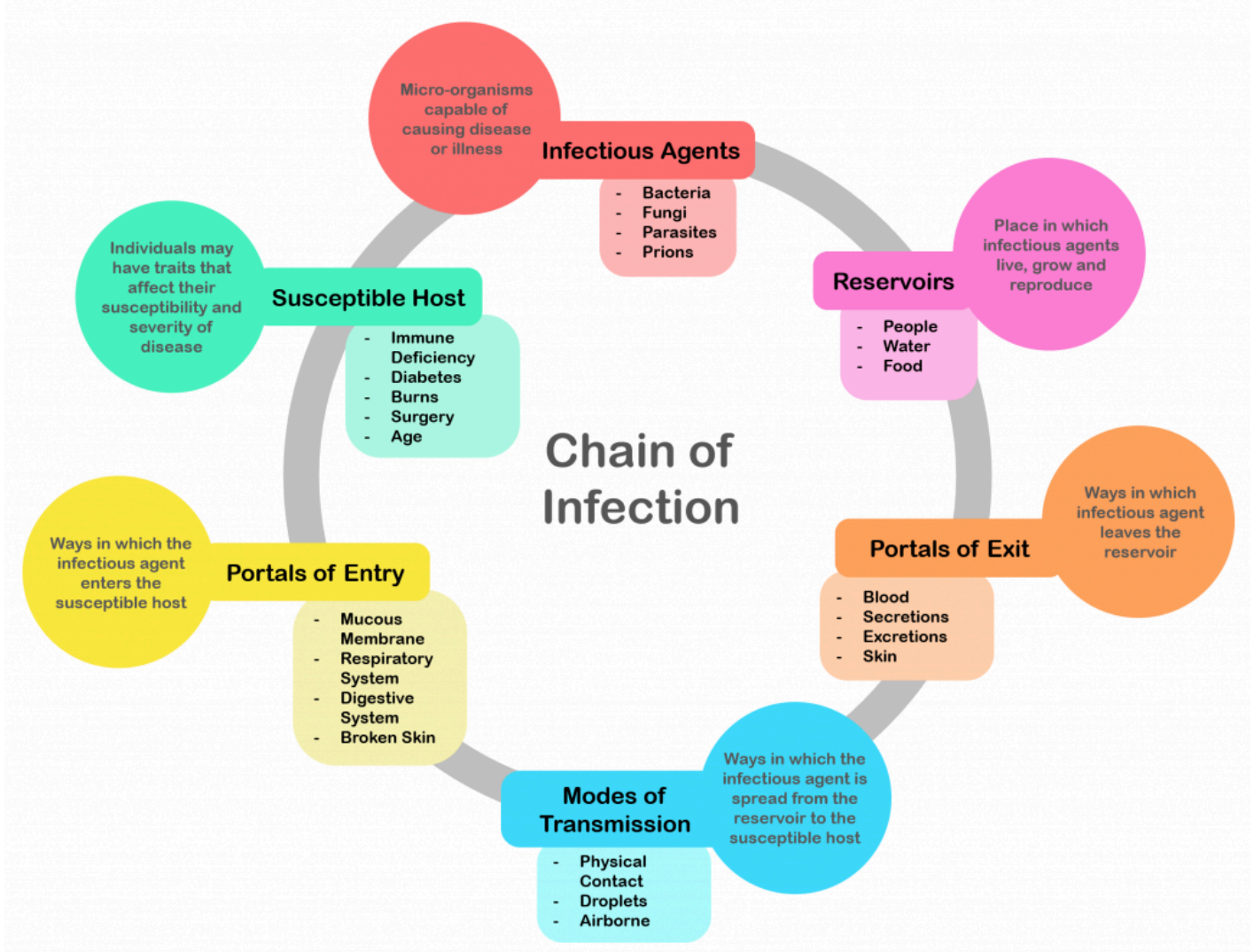


Figure 9.16 Chain of Infection

For a pathogen to continue to exist, it must put itself in a position to be transmitted to a new host, leaving the infected host through a portal of exit. Similar to portals of entry, the most common portals of exit include the skin and the respiratory, urogenital, and gastrointestinal tracts. Coughing and sneezing can expel thousands of pathogens from the respiratory tract into the environment. Other pathogens are expelled through feces, urine, semen,

and vaginal secretions. Pathogens that rely on insects for transmission exit the body in the blood extracted by a biting insect.³

The pathogen enters a new individual via a portal of entry, such as mucous membranes or nonintact skin. If the individual has a weakened immune system or their natural defenses cannot fend off the pathogen, they become infected.

Interventions to Break the Chain of Infection

Infections can be stopped from spreading by interrupting this chain at any link. Chain links can be broken by disinfecting the environment, sterilizing medical instruments and equipment, covering coughs and sneezes, using good hand hygiene, implementing standard and transmission-based precautions, appropriately using personal protective equipment, encouraging clients to stay up-to-date on vaccines (including the flu shot), following safe injection practices, and promoting the optimal functioning of the natural immune system with good nutrition, rest, exercise, and stress management.

Disinfection and Sterilization

Disinfection and **sterilization** are used to kill microorganisms and remove harmful pathogens from the environment and equipment to decrease the chance of spreading infection. Disinfection is the removal of microorganisms. However, disinfection does not destroy all spores and viruses. Sterilization is a process used on equipment and the environment to destroy all pathogens, including spores and viruses. Sterilization methods include steam, boiling water, dry heat, radiation, and chemicals. Because of the harshness of these sterilization methods, skin can only be disinfected and not sterilized.⁴

3. Parker, N., Schneegurt, M., Tu, A.-Hue T., Forster, B. M., & Lister, P. (2016). Microbiology. OpenStax. Access for free at <https://openstax.org/books/microbiology/pages/1-introduction>

4. Centers for Disease Control and Prevention. (2023). *Disinfection and*

Standard and Transmission-Based Precautions

To protect clients and health care workers from the spread of pathogens, the CDC has developed precautions to use during client care that address portals of exit, methods of transmission, and portals of entry. These precautions include standard precautions and transmission-based precautions.

Standard Precautions

Standard precautions are used when caring for all clients to prevent healthcare-associated infections. According to the Centers for Disease Control and Prevention (CDC), **standard precautions** are the minimum infection prevention practices that apply to all client care, regardless of suspected or confirmed infection status of the client, in any setting where health care is delivered. These precautions are based on the principle that all blood, body fluids (except sweat), nonintact skin, and mucous membranes may contain transmissible infectious agents. These standards reduce the risk of exposure for the health care worker and protect the client from potential transmission of infectious organisms.⁵ See Figure 9.17⁶ for an image of some of the components of standard precautions.

Current standard precautions according to the CDC include the following⁷:

sterilization guideline. https://www.cdc.gov/infection-control/hcp/disinfection-and-sterilization/?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/guidelines/disinfection/index.html

5. Centers for Disease Control and Prevention. (2024). *Standard precautions for all patient care.* <https://www.cdc.gov/infectioncontrol/basics/standard-precautions.html>

6. “[hand-disinfection-4954840_960_720.jpg](#)” by [KlausHausmann](#) is licensed under [CC0](#)

7. Centers for Disease Control and Prevention. (2024). *Standard precautions for*

- Appropriate hand hygiene
- Use of personal protective equipment (e.g., gloves, gowns, masks, eyewear) whenever infectious material exposure may occur
- Appropriate client placement and care using transmission-based precautions when indicated
- Respiratory hygiene/cough etiquette
- Proper handling and cleaning of environment, equipment, and devices
- Safe handling of laundry and textiles
- Safe injection practices⁸



Figure 9.17 Components of Standard Precautions

HAND HYGIENE

Hand hygiene, although simple, is still the best and most effective way to

all patient care. https://www.cdc.gov/infection-control/hcp/basics/standard-precautions.html?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/basics/standard-precautions.html

8. Centers for Disease Control and Prevention. (2024). Sharps Safety Program Resources. <https://www.cdc.gov/infection-control/hcp/sharps-safety/index.html>

prevent the spread of infection. The 2021 National Patient Safety Goals from The Joint Commission encourages infection prevention strategy practices such as implementing the hand hygiene guidelines from the Centers for Disease Control.⁹ Accepted methods for hand hygiene include using either soap and water or alcohol-based hand sanitizer. It is essential for all health care workers to use proper hand hygiene at the appropriate times, such as the following¹⁰ :

- Immediately before touching a client
- Before performing an aseptic task or handling invasive medical devices
- Before moving from a soiled body site to a clean body site on a client
- After touching a client or their immediate environment
- After contact with blood, body fluids, or contaminated surfaces (with or without glove use)
- Immediately after glove removal

Hand hygiene also includes health care workers keeping their nails short with tips less than 0.5 inches and no nail polish. Nails should be natural, and artificial nails or tips should not be worn. Artificial nails and chipped nail polish have been associated with a higher level of pathogens carried on the hands of the nurse despite hand hygiene.¹¹

9. Centers for Disease Control and Prevention. (2024). *Hand hygiene in healthcare settings*. <https://www.cdc.gov/handhygiene/>

10. Centers for Disease Control and Prevention. (2024). *Hand hygiene in healthcare settings*. <https://www.cdc.gov/handhygiene/>

11. Blackburn, L., Acree, K., Bartley, J., DiGiannantoni, E., Renner, E., & Sinnott, L. T. (2020). Microbial growth on the nails of direct patient care nurses wearing nail polish. *Nursing Oncology Forum*, 47(2), 155-164. <https://doi.org/10.1188/20.onf.155-164>

► Read more about using appropriate hand hygiene in the “[Aseptic Technique](#)” chapter in *Open RN Nursing Skills, 2e*.

RESPIRATORY HYGIENE/COUGH ETIQUETTE

Respiratory hygiene is targeted at clients, accompanying family members and friends, and staff members with undiagnosed transmissible respiratory infections. It applies to any person with signs of illness, including cough, congestion, or increased production of respiratory secretions when entering a health care facility. The elements of respiratory hygiene include the following:

- Education of health care facility staff, clients, and visitors
- Posted signs, in language(s) appropriate to the population served, with instructions to clients and accompanying family members or friends
- Source control measures for a coughing person (e.g., covering the mouth/nose with a tissue when coughing and prompt disposal of used tissues, or applying surgical masks on the coughing person to contain secretions)
- Hand hygiene after contact with one’s respiratory secretions
- Spatial separation, ideally greater than three feet, of persons with respiratory infections in common waiting areas when possible¹²

Health care personnel are advised to wear a mask and use frequent hand hygiene when examining and caring for clients with signs and symptoms of a respiratory infection. Health care personnel who have a respiratory infection are advised to stay home or avoid direct client contact, especially with high-

12. Centers for Disease Control and Prevention. (2024). *Standard precautions for all patient care*. https://www.cdc.gov/infection-control/hcp/basics/standard-precautions.html?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/basics/standard-precautions.html

risk clients. If this is not possible, then a mask should be worn while providing client care.¹³

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment (PPE) includes gloves, gowns, face shields, goggles, and masks used to prevent the spread of infection to and from clients and health care providers. See Figure 9.18¹⁴ for an image of a nurse wearing PPE. Depending upon the anticipated exposure and type of pathogen, PPE may include the use of gloves, a fluid-resistant gown, goggles or a face shield, and a mask or respirator. When used while caring for a client with transmission-based precautions, PPE supplies are typically stored in an isolation cart next to the client's room.

13. Centers for Disease Control and Prevention. (2024). *Standard precautions for all patient care*. https://www.cdc.gov/infection-control/hcp/basics/standard-precautions.html?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/basics/standard-precautions.html
14. “U.S. Navy Doctors, Nurses and Corpsmen Treat COVID Patients in the ICU Aboard USNS Comfort (49825651378).jpg” by Navy Medicine is licensed under CC0.



Figure 9.18 Personal Protective Equipment

► Read more about how to properly use personal protective equipment in the “[Aseptic Technique](#)” chapter in *Open RN Nursing Skills, 2e*.

Transmission-Based Precautions

In addition to standard precautions, **transmission-based precautions** are used for clients with documented or suspected infection of highly transmissible pathogens, such as *C. difficile* (C-diff), *Methicillin-resistant Staphylococcus aureus* (MRSA), *Vancomycin-resistant enterococci* (VRE), Respiratory Syncytial Virus (RSV), measles, and tuberculosis (TB). For clients with these types of pathogens, standard precautions are used along with specific transmission-based precautions.¹⁵

15. Siegel, J. D., Rhinehart, E., Jackson, M., Chiarello, L., & Healthcare Infection Control Practices Advisory Committee. (2019). *2007 guideline for isolation precautions: Preventing transmission of infectious agents in healthcare settings*. <https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html>

There are three categories of transmission-based precautions: contact precautions, droplet precautions, and airborne precautions. Transmission-based precautions are used when the route(s) of transmission of a specific disease are not completely interrupted using standard precautions alone.

Some diseases, such as tuberculosis, have multiple routes of transmission so more than one transmission-based precaution category must be implemented. See Table 9.6 outlining the categories of transmission precautions with associated PPE and other precautions. When possible, clients with transmission-based precautions should be placed in a single occupancy room with dedicated client care equipment (e.g., blood pressure cuffs, stethoscope, and thermometer stay in the client's room). A card is posted outside the door alerting staff and visitors to required precautions before entering the room. See Figure 9.19¹⁶ for an example of signage used for a client with contact precautions. Transport of the client and unnecessary movement outside the client room should be limited. When transmission-based precautions are implemented, it is also important for the nurse to make efforts to counteract possible adverse effects of these precautions on clients, such as anxiety, depression, perceptions of stigma, and reduced contact with clinical staff.¹⁷

Table 9.6 Transmission-Based Precautions¹⁸

16. [“Contact Precautions poster.pdf”](#) by U.S. Centers for Disease Control and Prevention is in the Public Domain
17. Siegel, J. D., Rhinehart, E., Jackson, M., Chiarello, L., & Healthcare Infection Control Practices Advisory Committee. (2019). *2007 guideline for isolation precautions: Preventing transmission of infectious agents in healthcare settings*. <https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html>
18. Siegel, J. D., Rhinehart, E., Jackson, M., Chiarello, L., & Healthcare Infection Control Practices Advisory Committee. (2019). *2007 guideline for isolation precautions: Preventing transmission of infectious agents in healthcare settings*. <https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html>

Precaution	Implementation	PPE and Other Precautions
Contact	Known or suspected infections with increased risk for contact transmission (e.g., draining wounds, fecal incontinence) or with epidemiologically important organisms, such as C-diff, MRSA, VRE, or RSV	Gloves Gown Dedicated equipment Limit client transport out of room Prioritized disinfection of the room Note: Use only soap and water for hand hygiene in clients with <i>C. difficile</i> infection.
Droplet	Known or suspected infection with pathogens transmitted by large respiratory droplets generated by coughing, sneezing, or talking, such as influenza or pertussis	Mask Goggles or face shield Dedicated equipment
Airborne	Known or suspected infection with pathogens transmitted by small respiratory droplets that travel through the air, such as measles and coronavirus	Fit-tested N-95 respirator Airborne infection isolation room Single-client room Client door closed Restricted susceptible personnel room entry Dedicated equipment



Figure 9.19 Contact Precautions Sign

► View a list of [Transmission Based Precautions](#) to use in addition to standard precautions from the

CLIENT TRANSPORT

Several principles are used to guide transport of clients requiring transmission-based precautions. During inpatient and residential settings, these principles include the following:

- Limit transport for essential purposes only, such as diagnostic and therapeutic procedures that cannot be performed in the client's room
- When transporting, use appropriate barriers on the client consistent with the route and risk of transmission (e.g., mask, gown, covering the affected areas when infectious skin lesions or drainage is present)
- Notify health care personnel in the receiving area of the impending arrival of the client and of the precautions necessary to prevent transmission¹⁹

ENTERIC PRECAUTIONS

Enteric precautions are used when there is the presence, or suspected presence, of gastrointestinal pathogens such as *Clostridium difficile* (C-diff) or norovirus. These pathogens are present in feces, so health care workers should always wear a gown in the client room to prevent inadvertent fecal contamination of their clothing from contact with contaminated surfaces.

In addition to contact precautions, enteric precautions include the following:

- Using only soap and water for hand hygiene. Do not use hand sanitizer

¹⁹. Siegel, J. D., Rhinehart, E., Jackson, M., Chiarello, L., & Healthcare Infection Control Practices Advisory Committee. (2019). *2007 guideline for isolation precautions: Preventing transmission of infectious agents in healthcare settings*. <https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html>

because it is not effective against C-diff spores.

- Using a special disinfecting process. Special disinfecting should be used after client discharge and includes disinfection of the mattress.

REVERSE ISOLATION

Reverse isolation, also called neutropenic precautions, is used for clients who have compromised immune systems and low neutrophil levels. This type of isolation protects the client from pathogens in their environment. In addition to using contact precautions to protect the client, reverse isolation precautions include the following:

- Meticulous hand hygiene by all visitors, staff, and the client
- Frequently monitoring for signs and symptoms of infection and sepsis
- Not allowing live plants, fresh flowers, fresh raw fruits or vegetables, sushi, deli foods, or cheese into the room due to bacteria and fungi
- Placement in a private room or a positive pressure room
- Limited transport and movement of the client outside of the room
- Masking of the client for transport with a surgical mask²⁰

▶ Read additional information about [Neutropenia and Risk for Infection](#).

PSYCHOLOGICAL EFFECTS OF ISOLATION

Although the use of transmission-based precautions is needed to prevent the spread of infection, it is important for nurses to be aware of the potential psychological impact on the client. Research has shown that isolation can cause negative impact on client mental well-being and behavior, including

20. Centers for Disease Control and Prevention. (n.d.). *What you need to know: Neutropenia and risk for infection*. <https://www.cdc.gov/cancer/preventinfections/pdf/neutropenia.pdf>

higher scores for depression, anxiety, and anger among isolated clients. It has also been found that health care workers spend less time with clients in isolation, resulting in a negative impact on client safety.²¹

Client and family education at the time of instituting transmission-based precautions is a critical component of the process to reduce anxiety and distress. Clients often feel stigmatized when placed in isolation, so it is important for them to understand the rationale of the precautions to keep themselves and others free from the spread of disease. Preparing clients emotionally will also help decrease their anxiety and help them cope with isolation.²² It is also important to provide distractions from boredom, such as music, television, video games, magazines, or books, as appropriate. Simple actions, such as charting while in the client's room, can also increase nurse-client interaction time.

Aseptic and Sterile Techniques

In addition to using standard precautions and transmission-based precautions, **aseptic technique** (also called medical asepsis) is used to prevent the transfer of microorganisms from one person or object to another during a medical procedure. For example, a nurse administering parenteral medication or performing urinary catheterization uses aseptic technique. When performed properly, aseptic technique prevents contamination and transfer of pathogens to the client from caregiver hands, surfaces, and equipment during routine care or procedures. It is important to remember

21. U.S. Department of Health and Human Services. (2020). *Health care-associated infections*. <https://health.gov/our-work/health-care-quality/health-care-associated-infections>
22. U.S. Department of Health and Human Services. (2020). *Health care-associated infections*. <https://health.gov/our-work/health-care-quality/health-care-associated-infections>

that potentially infectious microorganisms can be present in the environment, on instruments, in liquids, on skin surfaces, or within a wound.²³

There is often misunderstanding between the terms aseptic technique and sterile technique in the health care setting. Both asepsis and sterility are closely related with the shared concept being the removal of harmful microorganisms that can cause infection. In the most simplistic terms, aseptic technique involves creating a protective barrier to prevent the spread of pathogens, whereas sterile technique is a purposeful attack on microorganisms. **Sterile technique** (also called surgical asepsis) seeks to eliminate every potential microorganism in and around a sterile field while also maintaining objects as free from microorganisms as possible. Sterile fields are implemented during surgery, as well as during nursing procedures such as the insertion of a urinary catheter, changing dressings on open wounds, and performing central line care. See Figure 9.20²⁴ for an image of a sterile field during surgery. Sterile technique requires a combination of meticulous handwashing, creating and maintaining a sterile field, using long-lasting antimicrobial cleansing agents such as Betadine, donning sterile gloves, and using sterile devices and instruments.²⁵

23. Centers for Disease Control and Prevention. (2020). *Glossary of terms for infection prevention and control in dental settings*. <https://www.cdc.gov/oralhealth/infectioncontrol/glossary.htm>

24. "226589236-huge.jpg" by [TORWAISTUDIO](#) is used under license from [Shutterstock.com](https://www.shutterstock.com)

25. Tennant, K. (2022). *Sterile technique*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK459175/>



Figure 9.20 Surgical Asepsis

- ▶ Read additional information about aseptic and sterile technique in the “[Aseptic Technique](#)” in *Open RN Nursing Skills, 2e*.
- ▶ Read a continuing education article about [Sterile Technique](#) and surgical scrubbing.

Other Hygienic Client Care Interventions

In addition to implementing standard and transmission-based precautions and utilizing aseptic and sterile technique when performing procedures, nurses implement many interventions to place a client in the best health possible to prevent an infection or treat infection. These interventions include actions like encouraging rest and good nutrition, teaching stress management, providing good oral care, encouraging daily bathing, and changing linens. It is also important to consider how gripper socks, mobile devices, and improper glove usage can contribute to the transmission of pathogens.

ORAL CARE

Client hygiene is important in the prevention and spread of infection. Although oral care may be given a low priority, research has found that poor oral care is associated with the spread of infection, poor health outcomes, and poor nutrition. Oral care should be performed in the morning, after meals, and before bed.²⁶

DAILY BATHING

Daily bathing is another intervention that may be viewed as time-consuming and receive low priority, but it can have a powerful impact on decreasing the spread of infection. Studies have shown a significant decrease in healthcare-associated infections with daily bathing using chlorhexidine gluconate (CHG) wipes or solution. The use of traditional soap and water baths do not reduce infection rates as significantly as CHG products, and wash basins have also been shown to be a reservoir for pathogens.²⁷

LINENS

Changing bed linens, towels, and a gown regularly eliminates potential reservoirs of bacteria. Fresh linens also promote client comfort.

GRIPPER SOCKS

Have you ever thought about what happens to the bed linens when a client returns from a walk in the hallway with gripper socks and gets back into bed

26. Ackley, B., Ladwig, G., Makic, M. B., Martinez-Kratz, M., & Zanotti, M. (2020). *Nursing diagnosis handbook: An evidence-based guide to planning care* (12th ed.). Elsevier. pp. 546-552, 828-832.

27. Salamone, K., Yacoub, E., Mahoney, A. M., & Edward, K. L. (2013). Oral care of hospitalised older patients in the acute medical setting. *Nursing Research and Practice*, 2013, 827670. <https://doi.org/10.1155/2013/827670>

with these socks? Research demonstrates that pathogens from the floor are transferred to the client's bed linens from the gripper socks. Nurses should remove gripper socks that were used for walking before clients climb into bed. They should also throw the socks away when the client is discharged instead of sending them home.²⁸

CELLULAR PHONES AND MOBILE DEVICES

Research has shown that cell phones and mobile devices carry many pathogens and are dirtier than a toilet seat or the bottom of a shoe. Clients, staff, and visitors routinely bring these mobile devices into health care facilities, which can cause the spread of disease. Nurses should frequently wipe mobile devices with disinfectant. They should encourage clients and visitors to disinfect phones frequently and avoid touching the face after having touched a mobile device.²⁹

GLOVES

Although gloves are used to prevent the spread of infection, they can also contribute to the spread of infection if used improperly. For example, research has shown that hand hygiene opportunities are being missed because of the overuse of gloves. For example, a nurse may don gloves to suction a client but neglect to remove them and perform hand hygiene before performing the next procedure on the same client. This can potentially cause the spread of

28. Welle, M. K., Bliha, M., DeLuca, J., Frauhiger, A., & Lamichhane-Khadka, R. (2019). Bacteria on the soles of patient-issued nonskid slipper socks: An overlooked pathogen spread threat? *Orthopedic Nursing*, 38(1), 33-40. <https://doi.org/10.1097/nor.0000000000000516>

29. Morubagal, R. R., Shivappa, S. G., Mahale, R. P., & Neelambike, S. M. (2017). Study of bacterial flora associated with mobile phones of healthcare workers and non-healthcare workers. *Iranian Journal of Microbiology*, 9(3), 143–151. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5719508/>

secondary infection. The World Health Organization (WHO) states that gloves should be worn when there is an expected risk of exposure to blood or body fluids or to protect the hands from chemicals and hazardous drugs, but hand hygiene is the best method of disease prevention and is preferred over wearing gloves when the exposure risk is minimal. Nurses have the perception that wearing gloves provides extra protection and cleanliness. However, the opposite is true. Nonsterile gloves have a high incidence of contamination with a range of bacteria, which means that a gloved hand is dirtier than a washed hand. Research has shown that nearly 40% of the times that gloves are used in client care, there is cross contamination. The most striking example of cross contamination includes situations when gloves are used for toileting a client and not being removed before touching other surfaces or the client.^{30, 31, 32}

Glove-related contact dermatitis has also become an important issue in recent years as more and more nurses are experiencing damage to the hands. Contact dermatitis can develop from repeated use of gloves and develops as dry, itchy, irritated areas on the skin of the hands. See Figure 9.21³³ for an image of contact dermatitis from gloves. Because the skin is the first

30. Burdsall, D. P., Gardner, S. E., Cox, T., Schweizer, M., Culp, K. R., Steelman, V. M., & Herwaldt, L. A. (2017). Exploring inappropriate certified nursing assistant glove use in long-term care. *American Journal of Infection Control*, 45(9), 940-945. <https://doi.org/10.1016/j.ajic.2017.02.017>
31. Jain, S., Clezy, K., & McLaws, M. L. (2017). Glove: Use for safety or overuse? *American Journal of Infection Control*, 45(12), 1407-1410. <https://doi.org/10.1016/j.ajic.2017.08.029>
32. Welle, M. K., Bliha, M., DeLuca, J., Frauhiger, A., & Lamichhane-Khadka, R. (2019). Bacteria on the soles of patient-issued nonskid slipper socks: An overlooked pathogen spread threat? *Orthopedic Nursing*, 38(1), 33-40. <https://doi.org/10.1097/nor.0000000000000516>
33. "Dermatitis2015.jpg" by James Heilman, MD is licensed under [CC BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/)

line of defense in preventing pathogens from entering the body, maintaining intact skin is very important to prevent nurses from exposure to pathogens.



Figure 9.21 Contact Dermatitis

9.7 Applying the Nursing Process

OPEN RESOURCES FOR NURSING (OPEN RN)

Now that we have discussed the pathophysiology of our immune system and interventions to treat and prevent infection, let's apply this information to using the nursing process when providing client care.

Assessment

When assessing an individual who is feeling ill but has not yet been diagnosed with an infection, general symptoms associated with the prodromal period of disease may be present due to the activation of the immune system. These symptoms include a feeling of **malaise** (not feeling well), headache, fever, and lack of appetite. As an infection moves into the acute phase of disease, more specific signs and symptoms related to the specific type of infection will occur.

A fever is a common sign of inflammation and infection. A temperature of 38 degrees Celsius (100.4 degrees F) is generally considered a low-grade fever, and a temperature of 38.3 degrees Celsius (101 degrees F) is considered a fever.¹ As discussed earlier in this chapter, fever is part of the nonspecific innate immune response and can be beneficial in destroying pathogens. However, extremely elevated temperatures can cause cell and organ damage, and prolonged fever can cause dehydration.

Infection raises the metabolic rate, causing an increased heart rate. The

1. Abad, C., Fearday, A., & Safdar, N. (2010). Adverse effects of isolation in hospitalised patients: A systematic review. *The Journal of Hospital Infection*, 76(2), 97-102. <https://doi.org/10.1016/j.jhin.2010.04.027>

respiratory rate may also increase as the body rids itself of carbon dioxide created during increased metabolism. However, be aware that an elevated heart rate above 90 and a respiratory rate above 20 are also criteria for systemic inflammatory response syndrome (SIRS) in clients with an existing infection.

As an infection develops, the lymph nodes that drain that area often become enlarged and tender. The swelling indicates that the lymphocytes and macrophages in the lymph node are fighting the infection. If a skin infection is developing, general signs of inflammation, such as redness, warmth, swelling, and tenderness, will occur at the site. As white blood cells migrate to the site, purulent drainage may occur.

Some viruses, bacteria, and toxins cause gastrointestinal inflammation, resulting in loss of appetite, nausea, vomiting, and diarrhea.

See Table 9.7a for a comparison of expected findings on physical assessment versus unexpected findings indicating a new infectious process that requires notification of the health care provider.

Table 9.7a Expected Versus Unexpected Findings on Assessment Related to Infection

Assessment	Expected Findings	Unexpected Findings to Report to Health Care Provider
Vital Signs	Within normal range	New temperature over 100.4 F or 38 C.
Neurological	Within baseline level of consciousness	New or worsening confusion and/or worsening level of consciousness.
Wound or Incision	Progressive healing of a wound with no signs of infection	New or worsening redness, warmth, tenderness, or purulent drainage from a wound.
Respiratory	No cough or production of sputum	New or worsening cough and/or productive cough of purulent sputum. Adventitious breath sounds (crackles, rhonchi, wheezing). New or worsening dyspnea.
Genitourinary	Urine clear, light yellow without odor	Malodorous, cloudy, bloody urine, with increased frequency, urgency, or pain with urination.
Gastrointestinal	Good appetite and food intake; feces formed and brown	Loss of appetite. Nausea and vomiting. Diarrhea. Discolored or unusually malodorous feces.

		<p>*CRITICAL CONDITIONS requiring immediate notification of the provider and/or implementation of a sepsis protocol:</p> <p>Two or more of the following criteria in a client with an existing infection indicate SIRS:</p> <ul style="list-style-type: none"> • Body temperature over 38 or under 36 degrees Celsius • Heart rate greater than 90 beats/minute • Respiratory rate greater than 20 breaths/minute or PaCO₂ less than 32 mmHg • White blood cell count greater than 12,000 or less than 4,000 microliters or immature bands greater than 10%
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Life Span Considerations

Infants do not have well-developed immune systems, placing this group at higher risk of infection. Breastfeeding helps protect infants from some infectious diseases by providing passive immunity until their immune system matures. New mothers should be encouraged to breastfeed their newborns.²

2. Centers for Disease Control and Prevention. (2023). *Breastfeeding, Frequently*

On the other end of the continuum, the immune system gradually decreases in effectiveness with age, making older adults also more vulnerable to infection. Early detection of infection can be challenging in older adults because they may not have a fever or increased white blood cell count (WBC), but instead develop subtle changes like new mental status changes. For example, new, acute confusion is a classic sign of urinary tract infection on older adults. The most common infections in older adults are urinary tract infections (UTI), bacterial pneumonia, influenza, and skin infections.

Diagnostic Tests

Several types of diagnostic tests may be ordered by a health care provider when a client is suspected of having an infection, such as complete blood count with differential, Erythrocyte Sedimentation Rate (ESR), C-Reactive Protein (CRP), serum lactate levels, and blood cultures (if sepsis is suspected). Other cultures may be obtained based on the site of the suspected infection.

CBC WITH DIFFERENTIAL

When an infection is suspected, a complete blood count with differential is usually obtained.

A complete blood count (CBC) includes the red blood cell count (RBC), white blood cell count (WBC), platelets, hemoglobin, and hematocrit values. A differential provides additional information, including the relative percentages of each type of white blood cell. See Figure 9.22³ for an illustration of a complete blood count with differential.

asked questions (FAQs). https://www.cdc.gov/breastfeeding/php/faq/faq.html?CDC_AAref_Val=https://www.cdc.gov/breastfeeding/faq/index.htm

3. “Blausen_0425_Formed_Elements.png” by [BruceBlaus.com](https://www.blausen.com) staff is licensed under [CC BY 3.0](https://creativecommons.org/licenses/by/3.0/)

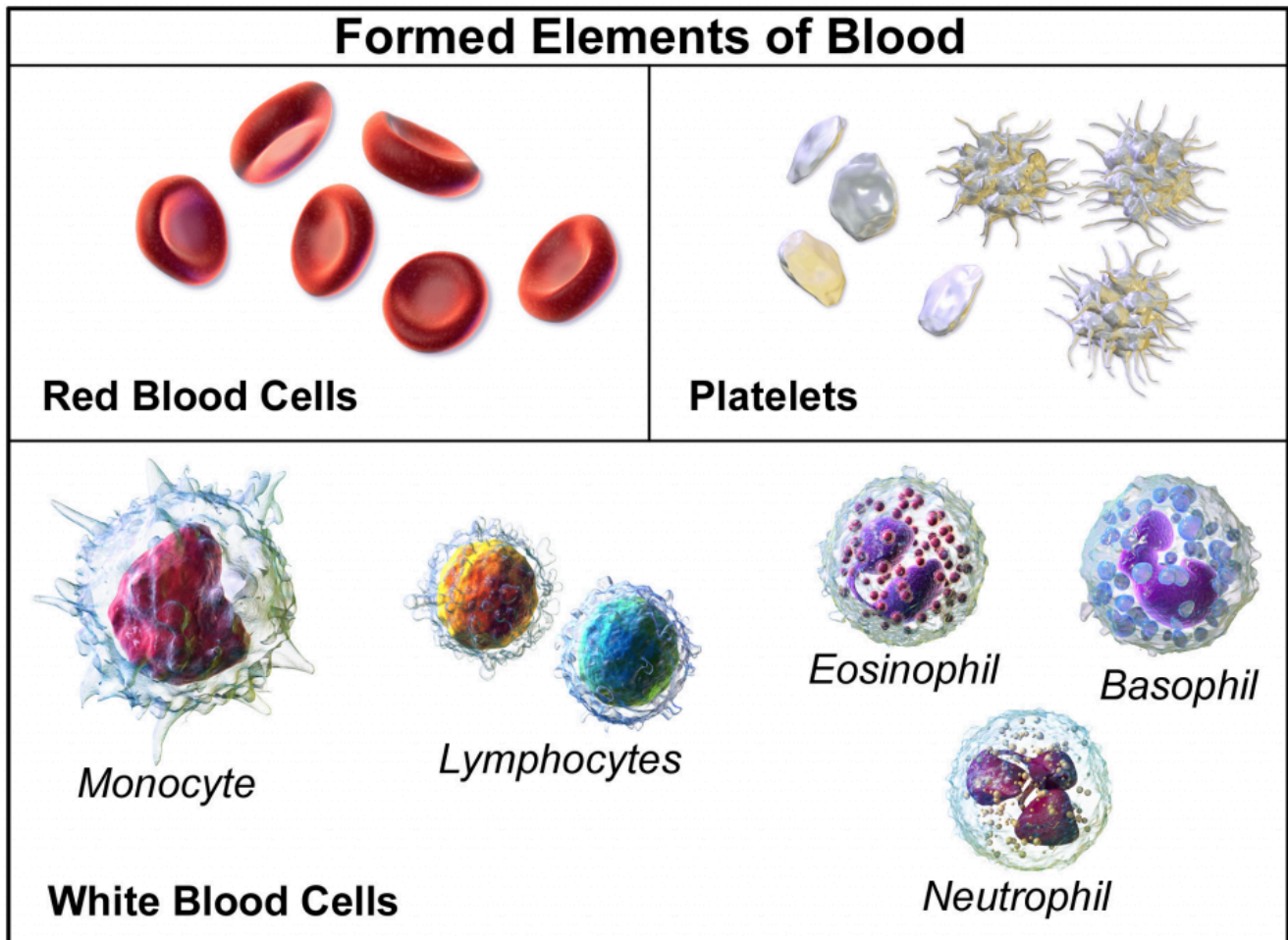


Figure 9.22 Components of a Complete Blood Count with Differential

When there is an infection or an inflammatory process somewhere in the body, the bone marrow produces more WBCs (also called leukocytes), releasing them into the blood where they move to the site of infection or inflammation. An increase in white blood cells is known as leukocytosis and is a sign of the inflammatory response. The normal range of WBC varies slightly from lab to lab but is generally 4,500-11,000 for adults, reported as $4.5-11.0 \times 10^9$ per liter (L).⁴

4. Centers for Disease Control and Prevention. (2023). *Candida auris*.

There are five types of white blood cells, each with different functions. The differential blood count gives the relative percentage of each type of white blood cell and also reveals abnormal white blood cells. The five types of white blood cells are as follows:

- Neutrophils
- Eosinophils
- Basophils
- Lymphocytes
- Monocytes

Neutrophils make up the largest number of circulating WBCs. They move into an area of damaged or infected tissue where they engulf and destroy bacteria or sometimes fungi. An elevated neutrophil count is called neutrophilia, and decreased neutrophil count is called neutropenia.⁵

Eosinophils respond to infections caused by parasites, play a role in allergic reactions (hypersensitivities), and control the extent of immune responses and inflammation. Elevated levels of eosinophils are referred to as eosinophilia.⁶

Basophils make up the fewest number of circulating WBCs and are thought to be involved in allergic reactions.⁷

https://www.cdc.gov/candida-auris/?CDC_AAref_Val=https://www.cdc.gov/fungal/candida-auris/index.html

5. Testing.com. (2022). *White blood cell count (WBC)*. <https://www.testing.com/tests/white-blood-cell-count-wbc/>

6. Testing.com. (2022). *White blood cell count (WBC)*. <https://www.testing.com/tests/white-blood-cell-count-wbc/>

7. Testing.com. (2022). *White blood cell count (WBC)*. <https://www.testing.com/tests/white-blood-cell-count-wbc/>

Lymphocytes include three types of cells, although the differential count does not distinguish among them:

- B lymphocytes (B cells) produce antibodies that target and destroy bacteria, viruses, and other “non-self” foreign antigens.
- T lymphocytes (T cells) mature in the thymus and consist of a few different types. Some T cells help the body distinguish between “self” and “non-self” antigens; some initiate and control the extent of an immune response, boosting it as needed and then slowing it as the condition resolves; and other types of T cells directly attack and neutralize virus-infected or cancerous cells.
- Natural killer cells (NK cells) directly attack and kill abnormal cells such as cancer cells or those infected with a virus.⁸

Monocytes, similar to neutrophils, move to an area of infection and engulf and destroy bacteria. They are associated with chronic rather than acute infections. They are also involved in tissue repair and other functions involving the immune system.⁹

Care must be taken when interpreting the results of a differential. A health care provider will consider an individual’s signs and symptoms and medical history, as well as the degree to which each type of cell is increased or decreased. A number of factors can cause a transient rise or drop in the number of any type of cell. For example, bacterial infections usually produce an increase in neutrophils, but a severe infection, like sepsis, can use up the available neutrophils, causing a low number to be found in the blood. Eosinophils are often elevated in parasitic and allergic responses. Acute viral

8. Testing.com. (2022). *White blood cell count (WBC)*. <https://www.testing.com/tests/white-blood-cell-count-wbc/>

9. Testing.com. (2022). *White blood cell count (WBC)*. <https://www.testing.com/tests/white-blood-cell-count-wbc/>

infections often cause an increased level of lymphocytes (referred to as lymphocytosis).¹⁰

ERYTHROCYTE SEDIMENTATION RATE (ESR)

An Erythrocyte Sedimentation Rate (ESR) is a test that indirectly measures inflammation. This test measures how quickly erythrocytes or red blood cells (RBCs) settle at the bottom of a test tube that contains a blood sample. When a sample of blood is placed in a tube, the red blood cells normally settle out relatively slowly, leaving a small amount of clear plasma. The red cells settle at a faster rate when there is an increased level of proteins, such as C-reactive protein (CRP), that increases in the blood in response to inflammation. The ESR test is not diagnostic; it is a nonspecific test indicating the presence or absence of an inflammatory condition.¹¹

C-REACTIVE PROTEIN (CRP)

C-Reactive Protein (CRP) levels in the blood increase when there is a condition causing inflammation somewhere in the body. CRP is a nonspecific indicator of inflammation and one of the most sensitive acute phase reactants, meaning it is released into the blood within a few hours after the start of an infection or other causes of inflammation. The level of CRP can jump as much as a thousand-fold in response to a severe bacterial infection, and its rise in the blood can precede symptoms of fever or pain.¹²

10. Testing.com. (2022). *White blood cell count (WBC)*. <https://www.testing.com/tests/white-blood-cell-count-wbc/>
11. Testing.com. (2022). *ESR blood test (erythrocyte sedimentation rate)*. <https://www.testing.com/tests/erythrocyte-sedimentation-rate-esr/>
12. Testing.com. (2022). *C reactive protein (CRP blood test)*. <https://www.testing.com/tests/c-reactive-protein-crp/>

LACTATE

Serum lactate levels are measured when sepsis is suspected in a client with an existing infection. Sepsis can quickly lead to septic shock and death due to multi-organ failure so early recognition is crucial.

Lactate is one of the substances produced by cells as the body turns food into energy (i.e., cellular metabolism), with the highest level of production occurring in the muscles. Normally, the level of lactate in blood is low. Lactate is produced in excess by muscle cells and other tissues when there is insufficient oxygen at the cellular level, causing metabolism to change from aerobic (with oxygen) to anaerobic (without oxygen).

Lactic acid can accumulate in the body and blood when it is produced faster than the liver can break it down, which can lead to lactic acidosis. Excess lactate may be produced due to several medical conditions that cause decreased transport of oxygen to the tissues, such as sepsis, hypovolemic shock, necrotic bowel, heart attack, heart failure, or respiratory distress.¹³

BLOOD CULTURE

Blood cultures are ordered when sepsis is suspected. In many facilities, lab personnel draw the 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 and to minimize false-positive cultures resulting from bacterial contamination of the site.

Blood cultures 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.

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

13. Testing.com. (2022). *Lactate*. <https://www.testing.com/tests/lactate/>

microbe causing the infection is identified and susceptibility testing is performed to inform the health care provider which antibiotics or other medications are most likely to be effective for treatment.

It is important for nurses to remember that when new orders for both antibiotics and a blood culture are received, antibiotics should not be administered until after the blood culture is drawn. Administering antibiotics before the blood culture is drawn will impact the results and adversely affect the treatment plan.

CULTURES AND OTHER DIAGNOSTIC TESTS

Several types of swabs and cultures may be ordered based on the site of a suspected infection, such as a nasal swab, nasopharyngeal swab, sputum culture, urine culture, and wound culture. If a lower respiratory tract infection is suspected, a chest X-ray may be ordered.

► Read additional information about the following topics in *Open RN Nursing Skills, 2e*:

- [“Specimen Collection”](#)
- Collecting urine cultures in [“Facilitation of Elimination”](#)
- Collecting wound cultures in [“Wound Care”](#)

THERAPEUTIC DRUG MONITORING

When antibiotics are prescribed to treat an infection, some types of antibiotics require blood tests to ensure the dosage of the medication reaches and stays within therapeutic ranges in the blood. These tests are often referred to as peak and/or trough levels. A peak level refers to when the medication is at its highest concentration in the bloodstream. A trough level is when the medication is at the lowest concentration in the bloodstream, just

prior to the next dose to be administered. The nurse must be aware of these orders because they impact the timing of administration of antibiotics.

▶ Read about therapeutic drug monitoring in the “[Therapeutic Levels](#)” section of the “Pharmacokinetics and Pharmacodynamics” chapter in *Open RN Nursing Pharmacology, 2e*.

Diagnoses

There are many NANDA-I nursing diagnoses applicable to infection. Nursing diagnoses associated with actual infections are customized based on the signs and symptoms of the specific infection (e.g., a client with pneumonia may have an actual nursing diagnosis of *Ineffective Airway Clearance*). Review a nursing care planning source for a list of current NANDA-I approved nursing diagnoses based on the type of infection occurring.

Two common risk diagnoses are *Risk for Infection* for clients at risk for developing an infection and *Risk for Shock* for clients with an existing infection who are at risk for developing sepsis and septic shock. See Table 9.7b for the risk diagnoses of *Risk for Infection* and *Risk for Shock*.

Table 9.7b NANDA-I Diagnoses Associated with Infection¹⁴

14. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.

NANDA-I Diagnosis	Definition	Other
Risk for Infection	Susceptible to invasion and multiplication of pathogenic organisms, which may compromise health	<p>Risk Factors</p> <ul style="list-style-type: none"> • Impaired skin integrity • Inadequate vaccination • Malnutrition • Obesity • Dysfunctional gastrointestinal motility • Smoking • Stasis of body fluid
Risk of Shock	Susceptible to inadequate blood flow to the body's tissues that may lead to life-threatening cellular dysfunction, which may compromise health	<p>Risk Factors</p> <ul style="list-style-type: none"> • Deficient fluid volume • Hypoxia • Ineffective medication self-management • Unstable blood pressure <p>Associated Conditions</p> <ul style="list-style-type: none"> • Infections • Systemic inflammatory response syndrome (SIRS) • Sepsis

Examples

For example, a nurse caring for a client with an open wound assesses the wound regularly because clients with nonintact skin are always at increased risk for developing infection. A sample PES statement would be the following: *“Risk for Infection as evidenced by alteration in skin integrity and insufficient knowledge to avoid exposure to pathogens.”* The nurse plans to provide client education regarding care of the wound to prevent bacterial contamination during dressing changes.

Whenever caring for a client with an existing infection, nurses know it is important to closely monitor for signs of developing SIRS and sepsis. A sample PES statement for a client with an existing infection is as follows: *“Risk for Shock as evidenced by the associated condition of infection.”*

Note: Recall that in NANDA-I risk diagnoses, there are no etiological factors because a vulnerability reflects the potential for developing a problem. Read more about creating PES statements for risk diagnoses in the [“Nursing Process”](#) chapter.

Outcomes

An example of a broad goal for all clients is the following: *“The client will remain free from infection during their health care stay.”*¹⁵

An example of a SMART expected outcome to prevent infection is: *“The client will demonstrate how to perform dressing changes using aseptic technique prior to discharge from the hospital.”*

Read more about creating SMART outcomes in the [“Nursing Process”](#) chapter.

15. Centers for Disease Control and Prevention. (2016). *Standard precautions for all patient care*. <https://www.cdc.gov/infectioncontrol/basics/standard-precautions.html>

Planning Interventions

When planning interventions for a client who is at risk for developing an infection, the nurse selects interventions such as those listed in the following box.

Interventions for Infection Prevention^{16,17}

- Monitor aspects of preexisting conditions that increase a person's risk for infection
- Monitor for early signs of localized and systemic infection for clients at risk
- Monitor white blood cell (WBC) results
- Inspect skin and mucous membranes for redness, warmth, tenderness, or drainage
- Obtain cultures as needed
- Monitor for malaise or decreased energy level
- Screen all visitors for communicable disease
- Maintain aseptic technique during nursing procedures
- Use sterile technique for invasive procedures or care of open wounds
- Use universal precautions with all clients to prevent the spread of infection

16. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.

17. Wilson, J., Bak, A., & Loveday, H. P. (2017). Applying human factors and ergonomics to the misuse of nonsterile clinical gloves in acute care. *American Journal of Infection Control*, 45(7), 779-786. <https://doi.org/10.1016/j.ajic.2017.02.019>.

- Initiate and maintain transmission-based precautions for clients with communicable infection
- Promote sufficient nutritional intake
- Encourage fluid intake, as appropriate
- Encourage rest
- Ensure appropriate hygienic care, including proper hand hygiene, daily bathing, oral care, and perineal care performed by either the nurse or the client, as appropriate
- Moisturize dry skin to keep it intact
- Use strategies to prevent healthcare-acquired respiratory infection, such as incentive spirometry, coughing and deep breathing, positional changes, and early ambulation as appropriate
- Use strategies to prevent wound infection such as changing saturated dressings to reduce the potential reservoir of bacteria
- Teach the client and family members the importance of a nutritious diet, exercise, and adequate rest to promote healing and health at home
- Teach the client and family about signs and symptoms of infection and when to report them to the health care provider
- Encourage keeping recommended vaccinations up-to-date
- If a client smokes, encourage smoking cessation because smoking damages the mucociliary escalator and places the client at increased risk for infection
- Report signs and symptoms of suspected infection or sepsis to the health care provider
- Suspect an infection if an older adult client has new signs of lethargy or confusion

If a client has an infection with a fever, the nursing diagnosis *Hyperthermia* may be applicable. See the following box for interventions for clients with fever/hyperthermia.

Interventions for Hyperthermia

- Assess for associated symptoms such as diaphoresis, shaking chills (rigors)
- Monitor level of consciousness
- Adjust room temperature to the client's comfort without inducing chilling
- Administer antipyretics, as appropriate (e.g., acetaminophen, ibuprofen)
- Apply external cooling methods as needed (cold packs or cool sponge bath)
- Encourage fluid intake
- Monitor for signs of dehydration

Implementing Interventions

When caring for a client with an active infection, transmission-based precautions may be required based on the specific type of pathogen. Antibiotics and/or other antimicrobials are administered as prescribed, and the client and family are instructed how to take prescribed antibiotics with measures to prevent antibiotic resistance (i.e., complete prescribed length of therapy even if they feel better in a few days).

If cultures have been obtained, it is important to monitor and report new results to the provider to ensure the prescribed antibiotic therapy is appropriate based on susceptibility results.

It is important to continually monitor clients with an existing infection for signs of SIRS/sepsis¹⁸ :

- Carefully monitor vital signs. Immediately notify the provider for two or more of the following indicators that suggest SIRS: heart rate greater than 90 beats per minute, temperature greater than 38 degrees C or less than 36 degrees C, systolic blood pressure less than 90 mm Hg, respiratory rate greater than 20, or a white blood cell count greater than 12,000 or less than 4,000. Anticipate new orders for a lactate level and blood cultures for early diagnosis of sepsis.
- Monitor for signs of new decreased mental status, especially in older adults, that can indicate decreased oxygenation or tissue perfusion associated with sepsis and septic shock.
- For clients presenting with early signs of shock, administer oxygen immediately to maintain oxygen saturation greater than 90%. Administer prescribed antibiotics within an hour after diagnosis for improved survival. Be aware that IV fluids and vasopressor medications may be required to treat shock.

► Read about different classes of antimicrobial agents in the “Antimicrobials” chapter in Open RN *Nursing Pharmacology*.

Evaluation

It is always important to evaluate the effectiveness of interventions used to prevent and treat infection. Evaluation helps the nurse determine whether the established outcomes have been met and if the planned interventions are still appropriate for the client at the time of implementation. If outcomes are

18. Chakraborty, R. K. (2023). *Systemic inflammatory response syndrome*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK547669/>

not met, interventions may need to be added or revised to help the client meet their goals.

9.8 Putting It All Together

Client Scenario

Mrs. Charles is a 74-year-old woman admitted to the medical-surgical floor with pneumonia. She has a history of right sided hemiplegia (paralysis on one side of the body) and dysphagia (difficulty swallowing) as a result of a cerebral vascular accident three years ago. Upon assessment, the client has a RR of 22 and rhonchi in her upper lobes. Her oxygenation saturation is 89% on room air, and she is utilizing accessory muscles during respiration.

Applying the Nursing Process

Assessment: The nurse notes that the client demonstrates tachypnea, hypoxemia, and abnormal breath sounds. She has a history of hemiplegia and dysphagia.

Based on the assessment information that has been gathered, the following nursing care plan is created for Mrs. Charles.

Nursing Diagnosis: *Ineffective Airway Clearance related to excessive mucus as evidenced by adventitious breath sounds and alteration in respiratory rate.*

Overall Goal: *The client will maintain patent airway at all times.*

SMART Expected Outcome: *Mrs. Charles will effectively clear secretions throughout the hospitalization.*

Planning and Implementing Nursing Interventions:

The nurse will assess the client's respiratory rate, rhythm, and depth of respiration. The nurse will assess and instruct the client on the methods of appropriate cough and deep breathing. The nurse will auscultate lung fields to identify areas of worsening airflow. The nurse will elevate the client's head of bed and encourage hydration to thin secretions. The nurse will instruct the client regarding proper deep breathing exercises and encourage assisted ambulation to mobilize secretions.

Sample Documentation:

Mrs. Charles has ineffective airway clearance with suspected aspiration secondary to dysphagia. The client has rhonchi in bilateral upper lobes, decreased oxygenation, and tachypnea. In order to enhance airway clearance and mobilize secretions, the client has received instruction to maintain fluid intake, increase ambulation, and cough and deep breathe. The client will maintain an elevated head of bed to encourage ease of respiration and will be assessed frequently for worsening respiratory status.

Evaluation:

During the client's hospitalization, she maintains a patent airway and effectively clears secretions resulting in improved respiratory effort and overall function. The SMART outcome was "met."

9.9 Learning Activities

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Activities

(Answers to “Learning Activities” can be found in the “Answer Key” at the end of the book. Answers to interactive activity elements will be provided within the element as immediate feedback.)

Ms. Jamison is a 37-year-old client presenting to the emergency department with an ongoing fever and chills for the last three days. She recently received treatment for a urinary tract infection but confesses that she stopped her antibiotic regimen when her symptoms resolved. Upon assessment, her vital signs are T – 101.6 F, HR 115, RR 20, BP 96/54. The admitting physician has ordered a Basic Metabolic Profile, Complete Blood Cell Count, and Urinalysis. The results are still pending. Based upon what is known about Ms. Jamison at this time, how would you characterize her condition? What characteristics lead you to suspect your diagnosis?

▶ Infection control practices are integral to health care workers and the clients and families that they serve. Proper infection control techniques enhance client safety and are foundational to quality client care. [Partnering to Heal](#) is a computer-based, video-simulation training program from the U.S. Department of Health and Human Services on infection control practices. Visit these web simulations to review infection control scenarios and the implications of various care decisions.

▶ Interested in testing your knowledge regarding the chain of infection? Visit [WISC-Online](#) “Chain of Infection” for a fun interactive quiz.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=1568#h5p-67>



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=1568#h5p-25>

Infection Case Study¹



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=1568#h5p-98>



Test your knowledge using this [NCLEX Next Generation-style](#)

1. “Infection Case Study” by Susan Jepsen for [Lansing Community College](#) are licensed under [CC BY 4.0](#)

▶ [question](#). You may reset and resubmit your answers to this question an unlimited number of times.²

2. “Chapter 9 Assignment 1” by Tami Davis for [OpenRN](#) is licensed under [CC BY-NC 4.0](#)

IX Glossary

OPEN RESOURCES FOR NURSING (OPEN RN)

Acute, self-limiting infections: Infections that develop rapidly and generally last only 10-14 days. Colds, ear infections, and coughs are considered acute, self-limiting infections. ([Chapter 9.4](#))

Adhesion: Capability of pathogenic microbes to attach to the cells of the body. ([Chapter 9.4](#))

Antibodies: Y proteins created by B cells that are specific to each pathogen and lock onto its surface and mark it for destruction by other immune cells. The five classes of antibodies are IgG, IgM, IgA, IgD, and IgE. ([Chapter 9.3](#))

Aseptic technique: The purposeful reduction of pathogens to prevent the transfer of microorganisms from one person or object to another during a medical procedure. For example, a nurse administering parenteral medication or performing urinary catheterization uses aseptic technique. When performed properly, aseptic technique prevents contamination and transfer of pathogens to the client from caregiver hands, surfaces, and equipment during routine care or procedures. ([Chapter 9.6](#))

B cells: Immune cells that mature in the bone marrow. B cells make Y-shaped proteins called antibodies that are specific to each pathogen and lock onto its surface and mark it for destruction by other immune cells. ([Chapter 9.3](#))

Bacteremia: The presence of bacteria in blood. ([Chapter 9.4](#))

Chronic infections: Infections that may persist for months. Hepatitis and mononucleosis are examples of chronic infections. ([Chapter 9.4](#))

Convalescent period: The final period of disease. ([Chapter 9.4](#))

Cytokines: Plasma proteins that communicate with other body organs and cells in the body to respond to and initiate inflammation. ([Chapter 9.3](#))

Cytokine storm: A severe immune reaction in which the body releases too many cytokines into the blood too quickly. A cytokine storm can occur as a result of an infection, autoimmune condition, or other disease. Signs and symptoms include high fever, inflammation, severe fatigue, and nausea. A

cytokine storm can be severe or life-threatening and lead to multiple organ failure.¹ ([Chapter 9.3](#))

Disease: Infections can lead to disease that causes signs and symptoms resulting in a deviation from the normal structure or functioning of the host. ([Chapter 9.4](#))

Disinfection: Removal of organisms from inanimate objects and surfaces. However, disinfection does not typically destroy all spores and viruses. ([Chapter 9.6](#))

Exposure: An encounter with a potential pathogen. ([Chapter 9.4](#))

Healthcare-Associated Infection (HAI): An infection that is contracted in a health care facility or under medical care. ([Chapter 9.4](#))

Incubation period: The period of a disease after the initial entry of the pathogen into the host but before symptoms develop. ([Chapter 9.4](#))

Infection: The invasion and growth of a microorganism within the body. ([Chapter 9.4](#))

Inflammation: A response triggered by a cascade of chemical mediators that occur when pathogens successfully breach the nonspecific physical defenses of the immune system or when an injury occurs. ([Chapter 9.3](#))

Invasion: The spread of a pathogen throughout local tissues or the body. ([Chapter 9.4](#))

Local infection: Infection confined to a small area of the body, typically near the portal of entry, and usually presents with signs of redness, warmth, swelling, and pain. Purulent drainage may be present and extensive tissue involvement can cause decreased function. ([Chapter 9.4](#))

Malaise: Not feeling well. ([Chapter 9.7](#))

Microbiome: Every human being carries their own individual suite of microorganisms in and on their body referred to as their microbiome. A person's microbiome is acquired at birth and evolves over their lifetime. It is different across body sites and between individuals. ([Chapter 9.2](#))

1. National Cancer Institute. (n.d.) *NCI dictionary of cancer terms*.

<https://www.cancer.gov/publications/dictionaries/cancer-terms/def/cytokine-storm>

Nonspecific innate immunity: A system of defenses in the body that targets invading pathogens in a nonspecific manner that is present from the moment we are born. Nonspecific innate immunity includes physical defenses, chemical defenses, and cellular defenses. ([Chapter 9.3](#))

Normal flora: Microorganisms that live on our skin and in the nasopharynx and gastrointestinal tracts and don't cause an infection unless the host becomes susceptible. ([Chapter 9.2](#))

Opportunistic pathogen: A pathogen that only causes disease in situations that compromise the host's defenses, such as the body's protective barriers, immune system, or normal microbiota. Individuals susceptible to opportunistic infections include the very young, the elderly, women who are pregnant, clients undergoing chemotherapy, people with immunodeficiencies (such as acquired immunodeficiency syndrome [AIDS]), clients who are recovering from surgery, and those who have had a breach of protective barriers (such as a severe wound or burn). ([Chapter 9.4](#))

Pathogens: Microorganisms that cause disease. ([Chapter 9.2](#))

Pathogenicity: The ability of a microorganism to cause disease. ([Chapter 9.4](#))

Peristalsis: Involuntary contraction and relaxation of the muscles of the intestine, creating wave-like movements that push digested content forward in the digestive tract. ([Chapter 9.3](#))

Personal Protective Equipment (PPE): Gloves, gowns, face shields, goggles, and masks used to prevent the spread of infection to and from clients and health care providers. ([Chapter 9.6](#))

Portal of entry: An anatomic site through which pathogens can pass into a host, such as mucous membranes, skin, respiratory, or digestive systems. ([Chapter 9.4](#))

Primary pathogen: A pathogen that can cause disease in a host regardless of the host's resident microbiota or immune system. ([Chapter 9.4](#))

Prodromal period: The disease stage after the incubation period when the pathogen continues to multiply and the host begins to experience general signs and symptoms of illness that result from activation of the immune system, such as fever, pain, soreness, swelling, or inflammation. Usually, such

signs and symptoms are too general to indicate a particular disease. ([Chapter 9.4](#))

Secondary infection: An infection that occurs during or after treatment for a different infection. It may be caused by the treatment for the first infection or a result of a diminished immune system or the elimination of normal flora. For example, a yeast infection that occurs after a client is treated with antibiotics is a secondary infection. ([Chapter 9.4](#))

Sepsis: An existing infection that triggers an exaggerated inflammatory reaction called SIRS throughout the body. If left untreated, sepsis causes tissue damage and quickly spreads to multiple organs. It is a life-threatening medical emergency. ([Chapter 9.4](#))

Septicemia: Bacteria that are both present and multiplying in the blood. ([Chapter 9.4](#))

Septic shock: Severe sepsis that leads to a life-threatening decrease in blood pressure (systolic pressure <90 mm Hg), preventing cells and other organs from receiving enough oxygen and nutrients. It can cause multi-organ failure and death. ([Chapter 9.4](#))

Specific adaptive immunity: The immune response that is activated when the nonspecific innate immune response is insufficient to control an infection. There are two types of adaptive responses: the cell-mediated immune response, which is carried out by T cells, and the humoral immune response, which is controlled by activated B cells and antibodies. ([Chapter 9.3](#))

Standard precautions: The minimum infection prevention practices that apply to all client care, regardless of suspected or confirmed infection status of the client, in any setting where health care is delivered. ([Chapter 9.6](#))

Sterile technique: A process, also called surgical asepsis, used to eliminate every potential microorganism in and around a sterile field while also maintaining objects as free from microorganisms as possible. It is the standard of care for surgical procedures, invasive wound management, and central line care. Sterile technique requires a combination of meticulous hand washing, creating a sterile field, using long-lasting antimicrobial cleansing agents such as Betadine, donning sterile gloves, and using sterile devices and instruments. ([Chapter 9.6](#))

Sterilization: A process used to destroy all pathogens from inanimate objects, including spores and viruses. ([Chapter 9.6](#))

Systemic infection: An infection that becomes disseminated throughout the body. ([Chapter 9.4](#))

Systemic Inflammatory Response Syndrome (SIRS): An exaggerated inflammatory response to a noxious stressor (including, but not limited to, infection and acute inflammation) that affects the entire body. ([Chapter 9.4](#))

T cells: Immune cells that mature in the thymus. T cells are categorized into three classes: helper T cells, regulatory T cells, and cytotoxic T cells. Helper T cells stimulate B cells to make antibodies and help killer cells develop. Killer T cells directly kill cells that have already been infected by a pathogen. T cells also use cytokines as messenger molecules to send chemical instructions to the rest of the immune system to ramp up its response. ([Chapter 9.3](#))

Transmission-based precautions: Precautions used for clients with documented or suspected infection, or colonization, of highly transmissible pathogens, such as *C. difficile* (C-diff), *Methicillin-resistant Staphylococcus aureus* (MRSA), *Vancomycin-resistant enterococci* (VRE), Respiratory Syncytial Virus (RSV), measles, and tuberculosis (TB). Three categories of transmission-based precautions are contact precautions, droplet precautions, and airborne precautions. ([Chapter 9.6](#))

Virulence: The degree to which a microorganism is likely to become a disease. ([Chapter 9.4](#))

PART X

INTEGUMENTARY

10.1 Integumentary Introduction

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Objectives

- Describe risk factors for integumentary disorders
- Identify cues related to alterations in integumentary system across the life span
- Differentiate findings among diverse clients
- Identify interventions to preserve skin integrity
- Contribute to a plan of care for clients with integumentary disorders

The integumentary system includes skin, hair, and nails. The skin is the largest organ of the body and has many purposes. Our skin keeps us warm and contains nerve endings that control the ability to feel the sensations of hot, cold, pain, and pressure. Our skin also keeps harmful things out of the body, such as dirt, bacteria, and viruses, and keeps helpful things like moisture in. Maintaining intact skin is important to prevent infection and maintain health. This chapter will review the anatomy and physiology of the integumentary system, factors that affect healthy skin and healing, and interventions that nurses perform to repair and protect this vital organ.

10.2 Integumentary Basic Concepts

OPEN RESOURCES FOR NURSING (OPEN RN)

Skin

Skin is made up of three layers: epidermis, dermis, and hypodermis. See Figure 10.1¹ for an illustration of skin layers. The **epidermis** is the thin, topmost layer of the skin. It contains sweat gland duct openings and the visible part of hair known as the hair shaft. Underneath the epidermis lies the **dermis** where many essential components of skin function are located. The dermis contains hair follicles (the roots of hair shafts), sebaceous oil glands, blood vessels, endocrine sweat glands, and nerve endings. The bottommost layer of skin is the **hypodermis** (also referred to as the subcutaneous layer). It mostly consists of adipose tissue (fat), along with some blood vessels and nerve endings. Beneath the hypodermis layer lies bone, muscle, ligaments, and tendons.

1. ["501 Structure of the skin.jpg"](https://openstax.org/books/anatomy-and-physiology/pages/5-1-layers-of-the-skin) by [OpenStax](https://openstax.org) is licensed under [CC BY 3.0](https://creativecommons.org/licenses/by/3.0/). Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/5-1-layers-of-the-skin>

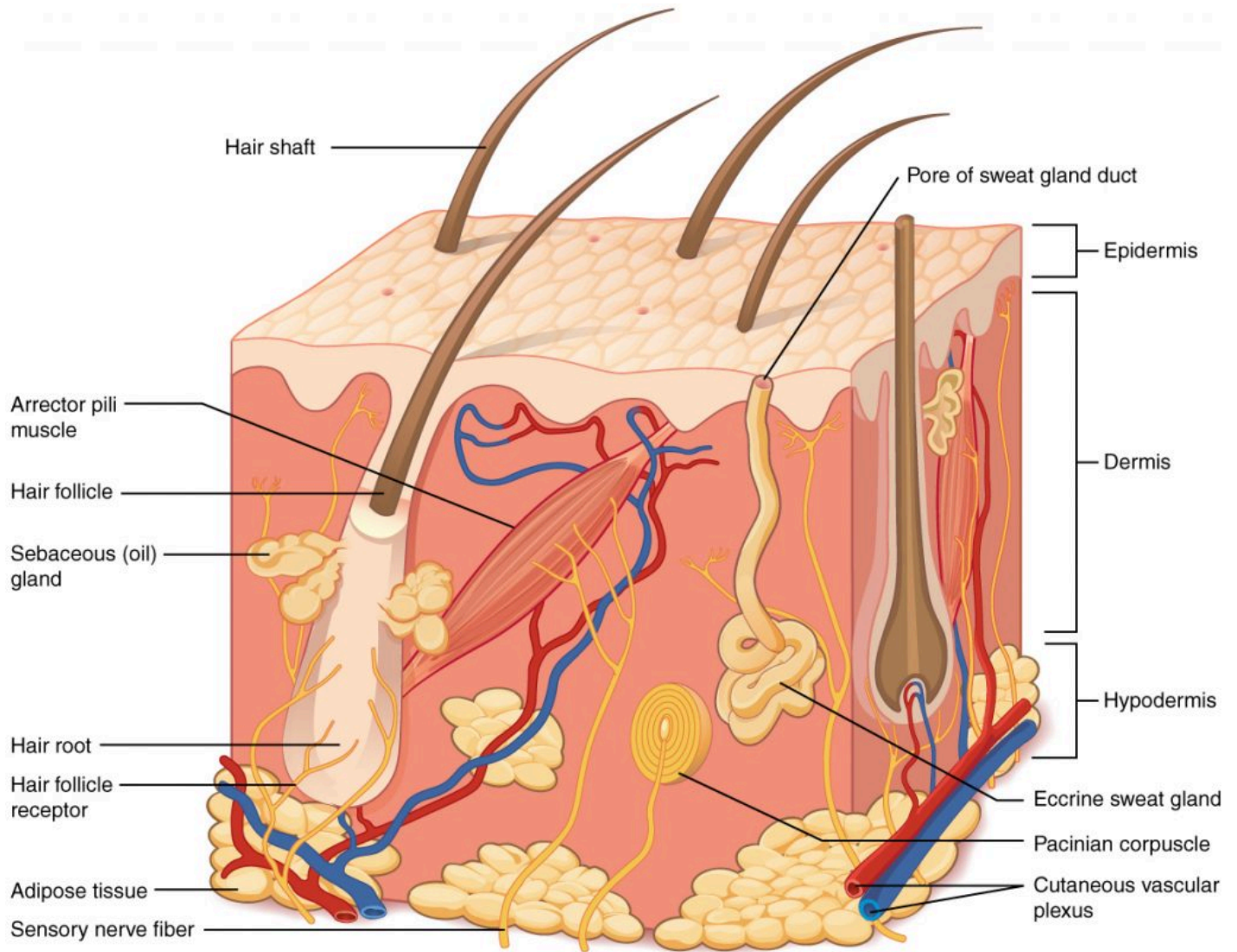


Figure 10.1 Layers of the Skin

Hair

Hair is a filament that grows from a hair follicle in the dermis of the skin. See Figure 10.2² for an illustration of a hair follicle. It consists mainly of tightly packed, keratin-filled cells called keratinocytes. The human body is covered

2. "506 Hair.jpg" by OpenStax is licensed under CC BY 3.0. Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/5-2-accessory-structures-of-the-skin>.

with hair follicles except for the mucous membranes, lips, palms of the hands, and soles of the feet. The part of the hair that is located within the follicle is called the hair root, the only living part of the hair. The part of the hair that is visible above the surface of the skin is the hair shaft. The shaft of the hair has no biochemical activity and is considered dead.

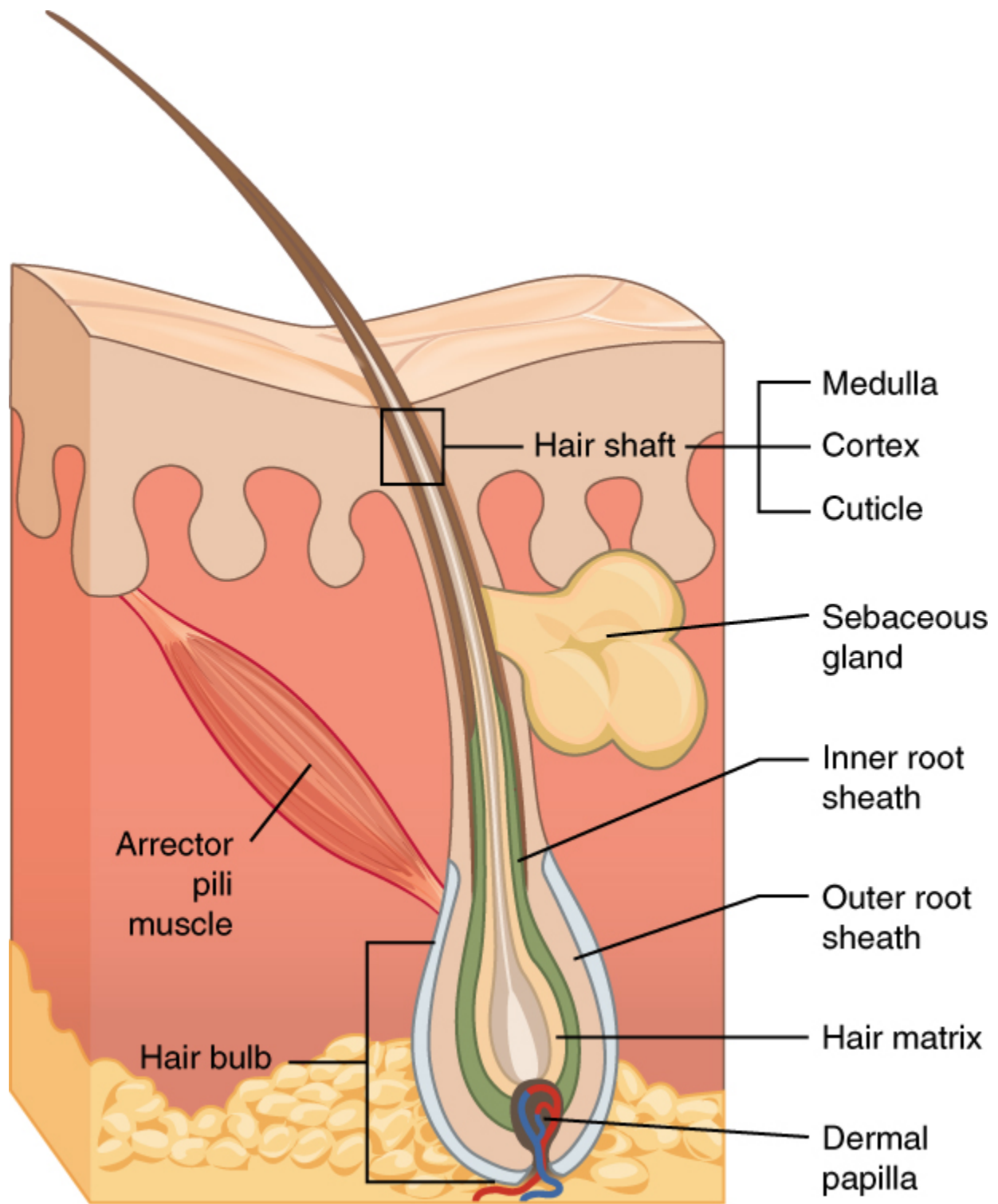


Figure 10.2 Hair Follicle

Functions of Hair

The functions of head hair are to provide insulation to retain heat and to protect the skin from damage by UV light. The function of hair in other locations on the body is debated. One idea is that body hair helps to keep us warm in cold weather. When the body is cold, the arrector pili muscles contract, causing hairs to stand up and trapping a layer of warm air above the epidermis. However, this action is more effective in mammals that have thick hair than it is in relatively hairless human beings.

Human hair has an important sensory function as well. Sensory receptors in the hair follicles can sense when the hair moves, whether it is because of a breeze or the touch of a physical object. Some hairs, such as the eyelashes, are especially sensitive to the presence of potentially harmful matter. The eyebrows protect the eyes from dirt, sweat, and rain. In addition, the eyebrows play a key role in nonverbal communication by expressing emotions such as sadness, anger, surprise, and excitement.³

Nails

Nails are accessory organs of the skin. They are made of sheets of dead keratinocytes and are found on the distal ends of the fingers and toes. The keratin in nails makes them hard but flexible. Nails serve a number of purposes, including protecting the fingers, enhancing sensations, and acting like tools. A nail has three main parts: root, plate, and free margin. Other structures around or under the nail include the nail bed, cuticle, and nail fold.

3. Wakim, S. M., & Grewal, M. (2023). *Human biology*. Biology LibreTexts. [https://bio.libretexts.org/Bookshelves/Human_Biology/Human_Biology_\(Wakim_and_Grewal\)](https://bio.libretexts.org/Bookshelves/Human_Biology/Human_Biology_(Wakim_and_Grewal))

See Figure 10.3 for an illustration of the structure of a nail.^{4,5} The top diagram in this figure shows the external, visible part of the nail and the cuticle. The bottom diagram shows internal structures in a cross-section of the nail and nail bed.



Figure 10.3 Nail Bed

Impaired Skin and Tissue Integrity

Skin integrity is a medical term that refers to skin health. **Impaired skin integrity** is a NANDA-I nursing diagnosis defined as, "Altered epidermis/or

4. "[Blausen_0406_FingerNailAnatomy.png](#)" by [BruceBlaus](#) is licensed under [CC BY 3.0](#)

5. Wakim, S. M., & Grewal, M. (2023). *Human biology*. Biology LibreTexts. [https://bio.libretexts.org/Bookshelves/Human_Biology/Human_Biology_\(Wakim_and_Grewal\)](https://bio.libretexts.org/Bookshelves/Human_Biology/Human_Biology_(Wakim_and_Grewal))

dermis.”⁶ However, when deeper layers of the skin or integumentary structures are damaged, it is referred to as **impaired tissue integrity**. The NANDA-I definition of impaired tissue integrity is, “Damage to the mucous membrane, cornea, integumentary system, muscular fascia, muscle, tendon, bone, cartilage, joint capsule, and/or ligament.”⁷

Risk Factors Affecting Skin Health and Wound Healing

There are several risk factors that place a client at increased risk for altered skin health and delayed wound healing. Risk factors include impaired circulation and oxygenation, impaired immune function, diabetes, inadequate nutrition, obesity, exposure to moisture, smoking, and age. Each of these risk factors is discussed in more detail in the following subsections.

Impaired Circulation and Oxygenation

Skin, like every other organ in the body, depends on good blood perfusion to keep it healthy and functioning correctly. Cardiovascular circulation delivers important oxygen, nutrients, infection-fighting cells, and clotting factors to tissues. These elements are needed by skin, tissues, and nerves to properly grow, function, and repair damage. Without good cardiovascular circulation, skin becomes damaged. Damage can occur from poor blood perfusion from the arteries, as well as from poor return of blood through the veins to the heart. Common medical conditions that decrease cardiovascular circulation include cardiac disease, diabetes, and peripheral vascular disease (PVD). PVD

6. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.

7. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.

includes two medical conditions called arterial insufficiency and venous insufficiency.

ARTERIAL INSUFFICIENCY

Arterial insufficiency refers to a lack of adequately oxygenated blood movement in arteries to specific tissues. Arterial insufficiency can be a sudden, acute lack of oxygenated blood, such as when a blood clot in an artery blocks blood flow to a specific area. Arterial insufficiency can also be a chronic condition caused by peripheral vascular disease (PVD). As a person's arteries become blocked with plaque due to atherosclerosis, there is decreased blood flow to the tissues. Signs of arterial insufficiency are cool skin temperature, pale skin color, pain that increases with exercise, and possible arterial ulcers.

When oxygenated blood flow to tissues becomes inadequate, the tissue dies. This is called **necrosis**. Tissue death causes the skin and tissue to become **necrotic** (black). Necrotic tissue does not heal, so surgical debridement or amputation of the extremity becomes necessary for healing. See Figure 10.4⁸ for images of an arterial insufficiency ulcer and necrotic toes.



Figure 10.4 Arterial Insufficiency Ulcer and Necrotic Toes

8. "JCCD147F1.gif" and "Infective-necrosis-of-second-toe_fig5_40484391" by unknown are licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) and [CC BY-NC 4.0](https://creativecommons.org/licenses/by-nc/4.0/). Access for free at <https://www.sciforschenonline.org/journals/clinical-cosmetic-dermatology/JCCD147.php> and https://www.researchgate.net/figure/infective-necrosis-of-second-toe_fig5_40484391

VENOUS INSUFFICIENCY

Venous insufficiency occurs when the cardiovascular system cannot adequately return blood and fluid from the extremities to the heart. Venous insufficiency can cause stasis dermatitis when blood pools in the lower legs and leaks out into the skin and other tissues. Signs of venous insufficiency are edema, a brownish-leathery appearance to skin in the lower extremities, and venous ulcers that weep fluid.⁹ See Figure 10.5¹⁰ for an image of stasis dermatitis.



Figure 10.5 Stasis Dermatitis Due to Venous Insufficiency

9. Blackburn, L., Acree, K., Bartley, J., DiGiannantoni, E., Renner, E., & Sinnott, L. T. (2020). Microbial growth on the nails of direct patient care nurses wearing nail polish. *Nursing Oncology Forum*, 47(2), 155-164. <https://doi.org/10.1188/20.onf.155-164>
10. "3056fig1_opt.jpeg" by unknown is licensed under [CC BY-NC 4.0](https://creativecommons.org/licenses/by-nc/4.0/). Access for free at <https://www.medicaljournals.se/acta/content/html/10.2340/00015555-0692>

Impaired Immune Function

Skin contributes to the body's immune function and is also affected by the immune system. Intact skin provides an excellent first line of defense against microorganisms entering the body. This is why it is essential to keep skin intact. If skin does break down, the next line of defense is a strong immune system that attacks harmful invading organisms. However, if the immune system is not working well, the body is much more susceptible to infections. This is why maintaining intact skin, especially in the presence of an impaired immune system, is imperative to decrease the risk of infections.

Stress can cause an impaired immune response that results in delayed wound healing. Being hospitalized or undergoing surgery triggers the stress response in many clients. Medications, such as corticosteroids, also affect a client's immune function and can impair wound healing. When assessing a chronic wound that is not healing as expected, it is important to consider potential causes, such as stress and certain medications.

Diabetes

Diabetes can cause wounds to develop, as well as delayed healing of wounds. This is due to elevated blood glucose causing stiffening of arterial walls, resulting in decreased circulation and tissue hypoxia. Elevated blood glucose also reduces leukocyte function, directly affecting wound healing and risk for infection. Additionally, if clients with diabetes also have diabetic neuropathy, they do not feel pain associated with skin injuries, resulting in delayed treatment and further risk of infection.¹¹ Nurses provide vital health teaching to clients with diabetes to help them effectively manage the disease and prevent complications.

11. Spampinato, S. F., Caruso, G. I., De Pasquale, R., Sortino, M. A., & Merlo S. (2020). The treatment of impaired wound healing in diabetes: Looking among old drugs. *Pharmaceuticals*, 13(4), 60. <https://doi.org/10.3390/ph13040060>.

► Read more about diabetes in the “[Antidiabetics](#)” section of the “Endocrine” chapter in *Open RN Nursing Pharmacology, 2e*.

Inadequate Nutrition

A healthy diet is essential for maintaining healthy skin, as well as maintaining an appropriate weight. Nutrients that are particularly important for skin health include protein; vitamins A, C, D, and E; and minerals such as selenium, copper, and zinc.¹²

Nutritional deficiencies can have a profound impact on wound healing and must be addressed for chronic wounds to heal. Protein is one of the most important nutritional factors affecting wound healing. For example, in clients with pressure injuries, 30 to 35 kcal/kg of calorie intake with 1.25 to 1.5g/kg of protein and micronutrients supplementation are recommended daily.¹³ In addition, vitamin C and zinc have many roles in wound healing. It is important to collaborate with a dietician to identify and manage nutritional deficiencies when a client is experiencing poor wound healing.¹⁴

Read more about nutritional deficiencies and related nursing interventions in the “[Nutrition](#)” chapter.

12. Park, K. (2015). Role of micronutrients in skin health and function. *Biomolecules & Therapeutics*, 23(3), 207–217. <https://doi.org/10.4062/biomolther.2015.003>
13. Cox, J. (2019). Wound care 101. *Nursing*, 49(10), 32-39. <https://doi.org/10.1097/01.nurse.0000580632.58318.08>
14. Guo, S., & Dipietro, L. A. (2010). Factors affecting wound healing. *Journal of Dental Research*, 89(3), 219–229. <https://doi.org/10.1177/0022034509359125>

Obesity

In the same way a balanced diet is vital for healthy skin, a healthy weight is also imperative. Obese individuals are at increased risk for fungal and yeast infections in skin folds caused by increased moisture and friction. See Figure 10.6¹⁵ for an image of a fungal infection in the groin.¹⁶ Symptoms of yeast and fungal infection include redness and scaliness of the skin associated with itching.



Figure 10.6 Fungal Infection in the Groin

Obese clients also are at higher risk for wound complications due to a decreased supply of oxygenated blood flow to adipose tissue. Potential complications include infection, **dehiscence** (separation of the edges of a

15. "[Tinea cruris.jpg](#)" by Robertgascoin is licensed under [CC BY-SA 3.0](#)

16. Rosen, T. (2011). *Inflammatory candida intertrigo*. UpToDate.
<https://somepomed.org/articulos/contents/mobipreview.htm?0/29/474>

surgical wound), hematoma formation, pressure injuries, and venous ulcers.¹⁷ Evisceration is a rare but severe complication when an abdominal surgical incision separates and the abdominal organs protrude or come out of the incision. Nurses can educate clients about making healthy lifestyle choices to reduce obesity and the risk of dehiscence. See Figure 10.7¹⁸ for an image of a dehiscence in an abdominal surgical wound of an obese client.



Figure 10.7 Dehiscence

Exposure to Moisture

Healthy skin needs good moisture balance. If too much moisture (i.e., sweat, urine, or water) is left on the skin for extended periods of time, the skin will become soggy, wrinkly, and turn whiter than usual and is called **maceration**.

17. Guo, S., & Dipietro, L. A. (2010). Factors affecting wound healing. *Journal of Dental Research*, 89(3), 219–229. <https://doi.org/10.1177/0022034509359125>

18. “[Bogota bag.png](#)” by Suarez-Grau, J. M., Guadalajara Jurado, J. F., Gómez Menchero, J., & Bellido Luque, J. A. is licensed under [CC BY 4.0](#)

A simple example of maceration is when you spend too much time in a bathtub and your fingers and toes turn white and get “pruny.” See Figure 10.8¹⁹ for an image of maceration. If healthy skin is exposed to moisture for an extended period of time, such as when a moist wound dressing is incorrectly applied on healthy skin, the skin will break down. This type of skin breakdown is called excoriation. **Excoriation** refers to removal of the topmost surface of the skin, which results in redness and abrasions. See Figure 10.9²⁰ for an image of excoriation.



Figure 10.8 Maceration

19. [“Trench_foot.jpg”](#) by [Mehmet Karatay](#) is licensed under [CC BY-SA 3.0](#)

20. [“Dermatomyositis15.jpg”](#) by Elizabeth M. Dugan, Adam M. Huber, Frederick W. Miller, and Lisa G. Rider is licensed under [CC BY-SA 3.0](#)



Figure 10.9 Excoriation

The opposite occurs when skin lacks proper moisture. Skin becomes flaky, itchy, and cracked when it becomes too dry. Conditions such as decreased moisture in the air during cold winter months or bathing in hot water can worsen skin dryness. Dry skin, especially when accompanied with cracking, breaks the protective barrier and increases the risk of infection. It is important for nurses to apply emollient cream to clients' areas of dry skin to maintain the protective skin barrier.

Smoking

Smoking impacts the inflammatory phase of the wound healing process, which can result in poor wound healing and an increased risk of infection, wound dehiscence, and necrosis. This is likely due to tissue hypoxia caused by toxins in tobacco smoke such as carbon monoxide and hydrogen cyanide, as

well as vasoconstriction caused by nicotine.^{21,22} Clients who smoke should be encouraged to stop smoking.

Age

Older adults have thin, less elastic skin that puts them at increased risk for injury. They also have an altered inflammatory response that can impair wound healing. Additionally, the elderly are at risk for poor nutrition that contributes to poor wound healing. Nurses teach older clients about the importance of exercise for skin health and improved wound healing as appropriate.²³

21. Guo, S., & Dipietro, L. A. (2010). Factors affecting wound healing. *Journal of Dental Research*, 89(3), 219–229. <https://doi.org/10.1177/0022034509359125>
22. McDaniel, J. C., & Browning, K. K. (2014). Smoking, chronic wound healing, and implications for evidence-based practice. *Journal of Wound, Ostomy, and Continence Nursing*, 41(5), 415-23. <https://doi.org/10.1097/WON.0000000000000057>
23. Guo, S., & Dipietro, L. A. (2010). Factors affecting wound healing. *Journal of Dental Research*, 89(3), 219–229. <https://doi.org/10.1177/0022034509359125>

10.3 Wounds

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Phases of Wound Healing

When skin is injured, there are four phases of wound healing that take place: hemostasis, inflammatory, proliferative, and maturation. See Figure 10.10¹ for an illustration of wound healing demonstrating hemostasis/inflammation, proliferation, and maturation.

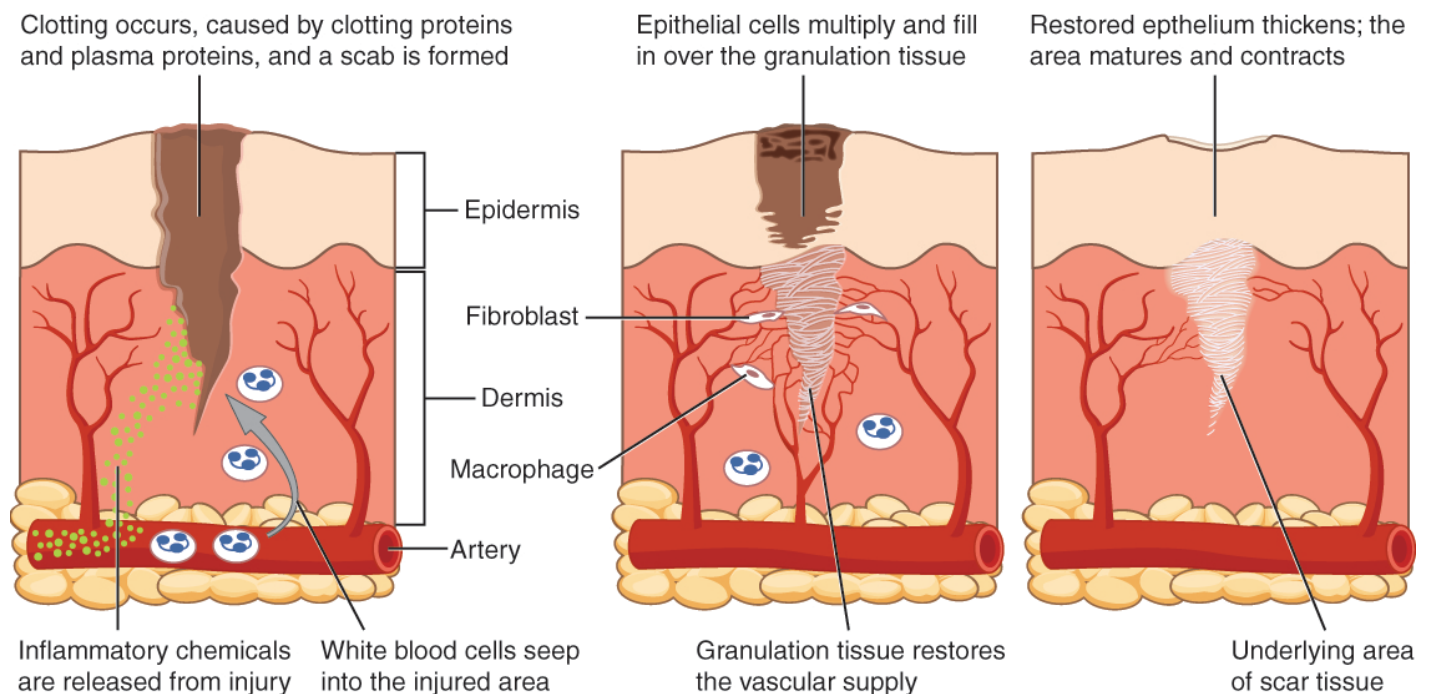


Figure 10.10 Phases of Wound Healing

1. "417 Tissue Repair.jpg" by OpenStax is licensed under CC BY 3.0. Access for free at <https://openstax.org/books/anatomy-and-physiology/pages/1-introduction>

To illustrate the phases of wound healing, imagine that you accidentally cut your finger with a knife as you were slicing an apple for a snack. Immediately after the injury occurs, blood vessels constrict and clotting factors are activated. This is referred to as the **hemostasis phase**. Clotting factors are released to form clots and to stop the bleeding. Platelets release growth factors that alert various cells to start the repair process at the wound location. The hemostasis phase lasts up to 60 minutes, depending on the severity of the injury.^{2,3}

After the hemostasis phase, the **inflammatory phase** begins. Vasodilation occurs so that white blood cells in the bloodstream can move to the location of the wound and start cleaning the wound bed. The inflammatory process appears as **edema** (swelling), **erythema** (redness), and exudate. **Exudate** is fluid that oozes out of a wound, such as pus or other drainage.^{4,5}

The **proliferative phase** of wound healing begins within a few days after the injury and includes four important processes: epithelialization, angiogenesis, collagen formation, and contraction. **Epithelialization** refers to the development of new epidermis and granulation tissue. **Granulation tissue** is new connective tissue with new, fragile, thin-walled capillaries. Collagen is

2. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BCcampus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
3. Grubbs, H. (2023). *Wound physiology*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK518964/>
4. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BCcampus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
5. Grubbs, H. (2023). *Wound physiology*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK518964/>

also formed to provide strength and integrity to the wound. At the end of the proliferation phase, the wound begins to contract in size.^{6,7}

Capillaries begin to develop within the wound 24 hours after injury during a process called **angiogenesis**. These capillaries bring more oxygen and nutrients to the wound for healing. When performing dressing changes, it is essential for the nurse to protect this granulation tissue and the associated new capillaries. Healthy granulation tissue appears pink due to the new capillary formation. It is moist, painless to the touch, and may appear “bumpy.” Conversely, unhealthy granulation tissue is dark red and painful. It bleeds easily with minimal contact and may be covered by shiny white or yellow fibrous tissue, referred to as biofilm, that impairs healing and should be removed by a trained health care provider. Unhealthy granulation tissue is often caused by an infection, so wound cultures should be obtained when infection is suspected.⁸

During the **maturation phase**, collagen continues to be created to strengthen the wound. Collagen contributes strength to the wound to prevent it from reopening. A wound typically heals within 4-5 weeks and often leaves behind a scar. The scar tissue is initially firm, red, and slightly

6. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BCcampus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
7. Grubbs, H. (2023). *Wound physiology*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK518964/>
8. McKay, M. (1990). The dermatologic history. In Walker, H. K., Hall, W. D., Hurst, J. W. (Eds.), *Clinical methods: The history, physical, and laboratory examinations* (3rd ed.). <https://www.ncbi.nlm.nih.gov/books/NBK207/>

raised from the excess collagen deposition. In roughly nine months, the scar begins to soften, flatten, and become pale.^{9,10}

Types of Wound Healing

There are three types of wound healing: primary intention, secondary intention, and tertiary intention. Healing by **primary intention** means that the wound is sutured, stapled, glued, or otherwise closed so the wound heals beneath the closure. This type of healing occurs with clean-edged lacerations or surgical incisions, and the closed edges are referred to as approximated. See Figure 10.11¹¹ for an image of a surgical wound healing by primary intention with **approximated edges**.



Figure 10.11 Primary Intention Wound Healing

9. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BCcampus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
10. Grubbs, H. (2023). *Wound physiology*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK518964/>
11. “[Ventriculoperitoneal shunt – surgical wound healing – belly – day 12.jpg](#)” by Hansmuller is licensed under [CC BY-SA 4.0](#)

Secondary intention occurs when the edges of a wound cannot be approximated (brought together), so the wound heals by filling in from the bottom up with the production of granulation tissue. Examples of common wounds that heal by secondary intention are pressure injuries and skin tears. Wounds that heal by secondary intention are at higher risk for infection and must be protected from contamination. See Figure 10.12¹² for an image of a wound that if left untreated, would heal by secondary intention.



Figure 10.12 Secondary Intention Wound Healing

Tertiary intention refers to the healing of a wound that has had to remain open or has been reopened, often due to severe infection or swelling. The wound is typically closed at a later date when infection or swelling has resolved. Wounds that heal by secondary and tertiary intention have delayed healing times and increased risk for infection and scar tissue.

Types of Wounds

There are many common types of wounds that nurses care for, such as skin tears, venous ulcers, arterial ulcers, diabetic ulcers, and pressure injuries.

¹². "[Atrophied skin.png](#)" by sansea2 is licensed under [CC BY-SA 3.0](#)

▶ Read more about different types of wounds and in the “[Wound Care](#)” chapter in *Open RN Nursing Skills, 2e*.

Wound Care

Wound care includes assessing and cleansing wounds, performing dressing changes, and implementing interventions to promote wound healing. Assessing wounds and implementing interventions to promote wound healing are further discussed in the “[Applying the Nursing Process](#)” section later in this chapter.

▶ See the “[Wound Care](#)” chapter in *Open RN Nursing Skills, 2e* for additional information about assessing wounds, cleansing wounds, and performing dressing changes.

10.4 Pressure Injuries

OPEN RESOURCES FOR NURSING (OPEN RN)

The remainder of this chapter will focus on applying the nursing process to a specific type of wound called a pressure injury. **Pressure injuries** are defined as, “Localized damage to the skin or underlying soft tissue, usually over a bony prominence, as a result of intense and prolonged pressure in combination with shear.” (Note that the 2016 NPUAP Pressure Injury Staging System now uses the term “pressure injury” instead of the historic term “pressure ulcer” because a pressure injury can occur without an ulcer present.) Pressure injuries commonly occur on the sacrum, heels, ischia, and coccyx and form when the skin layer of tissue gets caught between an external hard surface, such as a bed or chair, and the internal hard surface of a bone.

Shear occurs when tissue layers move over the top of each other, causing blood vessels to stretch and break as they pass through the subcutaneous tissue. For example, when a client slides down in bed, the outer layer of skin remains immobile because it remains attached to the sheets due to friction. However, the deeper layer of tissue (attached to bone) moves as the client slides down. This opposing movement of the outer layer of skin and the underlying tissues causes the capillaries to stretch and tear, which then causes decreased blood flow and oxygenation of the surrounding tissues resulting in a pressure injury.¹

Friction refers to rubbing the skin against a hard object, such as the bed or

1. Edsberg, L. E., Black, J. M., Goldberg, M., McNichol, L., Moore, L., & Sieggreen, M. (2016). Revised national pressure ulcer advisory panel pressure injury staging system: Revised pressure injury staging system. *Journal of Wound, Ostomy, and Continence Nursing: Official Publication of The Wound, Ostomy and Continence Nurses Society*, 43(6), 585–597. <https://doi.org/10.1097/WON.0000000000000281>

the arm of a wheelchair. This rubbing causes heat, which can remove the top layer of skin and often results in skin damage. See Figure 10.13² for an illustration of shear and friction forces in the development of pressure injuries.

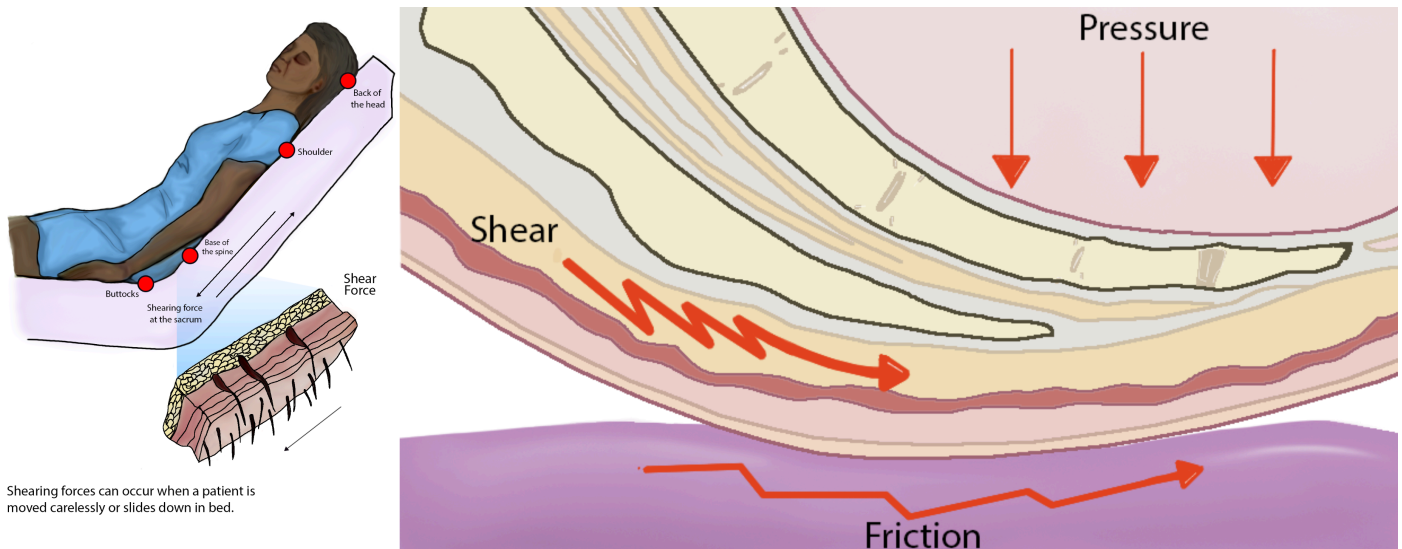


Figure 10.13 Development of Pressure Injuries

Hospital-acquired or worsening pressure injuries during hospitalization are considered “never events,” meaning they are a serious, preventable medical errors that should never occur and require reporting to The Joint Commission. Additionally, the Centers for Medicare and Medicaid Services (CMS) and many private insurers will no longer pay for additional costs associated with “never events.”^{3,4} Pressure injuries can be prevented with diligent assessment and

2. “Shear Force” and “Shear Force Closeup” by Meredith Pomietlo at [Chippewa Valley Technical College](#) are licensed under [CC BY 4.0](#)

3. Agency for Healthcare Research and Quality. (2019). *Never events*. psnet.ahrq.gov/primer/never-events

4. AMN Healthcare Education Services. (2020). *Pressure injury: Never event*. [rn.com/clinical-insight-pressure-injury/](https://www.rn.com/clinical-insight-pressure-injury/)

nursing interventions such as frequent repositioning and providing good skin care.

Staging

When assessed, pressure injuries are staged from 1 through 4 based on the extent of tissue damage. For example, Stage 1 pressure injuries have the least amount of tissue damage as evidenced by reddened, intact skin, whereas Stage 4 pressure injuries have the greatest amount of damage with deep, open ulcers affecting underlying tissue, muscle, ligaments, or tendons. See Figure 10.14⁵ for images of four stages of pressure injuries.⁶ Each stage is further described in the following subsections.



Figure 10.14 Four Stages of Pressure Injuries

5. “Wound stage.jpg” by Babagolzadeh is licensed under [CC BY-SA 3.0](#)
6. Edsberg, L. E., Black, J. M., Goldberg, M., McNichol, L., Moore, L., & Sieggreen, M. (2016). Revised national pressure ulcer advisory panel pressure injury staging system: Revised pressure injury staging system. *Journal of Wound, Ostomy, and Continence Nursing: Official Publication of The Wound, Ostomy and Continence Nurses Society*, 43(6), 585–597. <https://doi.org/10.1097/WON.0000000000000281>

Stage 1 Pressure Injuries

Stage 1 pressure injuries are intact skin with a localized area of **nonblanchable erythema** where prolonged pressure has occurred.

Nonblanchable erythema is a medical term used to describe an area of reddened skin that does not turn white when pressed. Nonblanchable erythema is an early sign of damage to underlying tissue caused by poor blood flow, ischemia, and damage to blood vessels in the area. Because damage is already present, there is a greater risk for Stage 1 pressure injuries to develop into worse pressure injuries if interventions to relieve pressure are not implemented. Skin with dark pigmentation may not demonstrate visible blanching, so it can be challenging to detect Stage 1 pressure injuries. For clients with dark pigmentation, nurses should assess for pain, firmness, softness, changes in temperature, or changes in color compared to surrounding areas.^{7,8}

See Figure 10.15⁹ for an illustration of a Stage 1 pressure injury.

7. Lindgren, M., Malmqvist, L. A., Sjöberg, F., & Ek, A.C. (2006) Altered skin blood perfusion in areas with non blanchable erythema: An explorative study. *International Wound Journal*, (3), 215-23. <https://doi.org/10.1111/j.1742-481X.2006.00238.x>.
8. Talley Group Limited. (2020). *PPPIA pressure ulcers in People with dark skin tones*. <https://www.talleygroup.com/medias/documents/PPPIA-Pressure-Ulcers-in-People-with-Dark-Skin-Tones-Poster-A3L-0-1604484440.pdf>
9. "Stage1-Darkly_Pigmented" and "Skin_01__healthy_skin_-_l_pigmen.jpg" provided by [National Pressure Injury Advisory Panel](#) are used with permission for educational purposes. Access for free at <https://npiap.com/page/PressureInjuryStages>

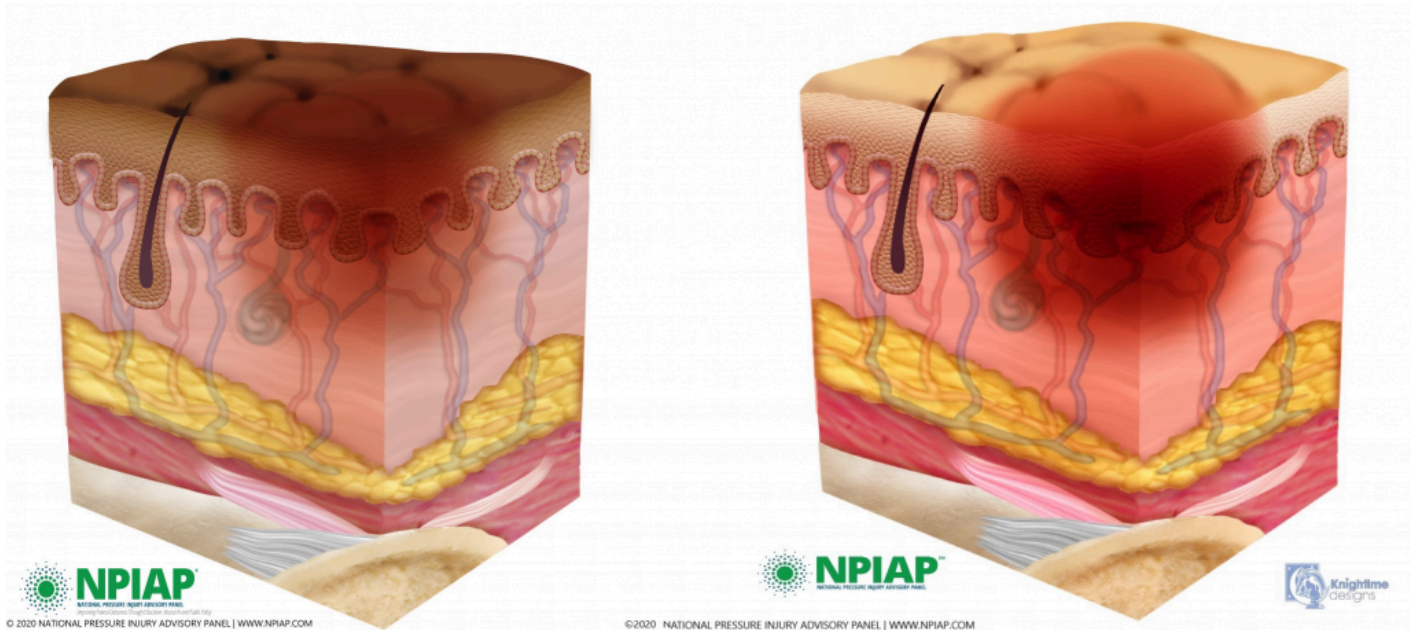


Figure 10.15 Stage 1 Pressure Injury. Used with permission.

Stage 2 Pressure Injuries

Stage 2 pressure injuries are partial-thickness loss of skin with exposed dermis. The wound has completely broken through the top layer of skin, and partly through the second layer, resulting in a shallow wound. The wound is shallow and generally open. The wound bed is viable and may appear like an intact or ruptured blister.¹⁰ The wound area may be painful and the

10. Edsberg, L. E., Black, J. M., Goldberg, M., McNichol, L., Moore, L., & Sieggreen, M. (2016). Revised national pressure ulcer advisory panel pressure injury staging system: Revised pressure injury staging system. *Journal of Wound, Ostomy, and Continence Nursing: Official Publication of The Wound, Ostomy and Continence Nurses Society*, 43(6), 585–597. <https://doi.org/10.1097/WON.0000000000000281>

surrounding tissue may be swollen or discolored.¹¹ See Figure 10.16¹² for an illustration of a Stage 2 pressure injury.

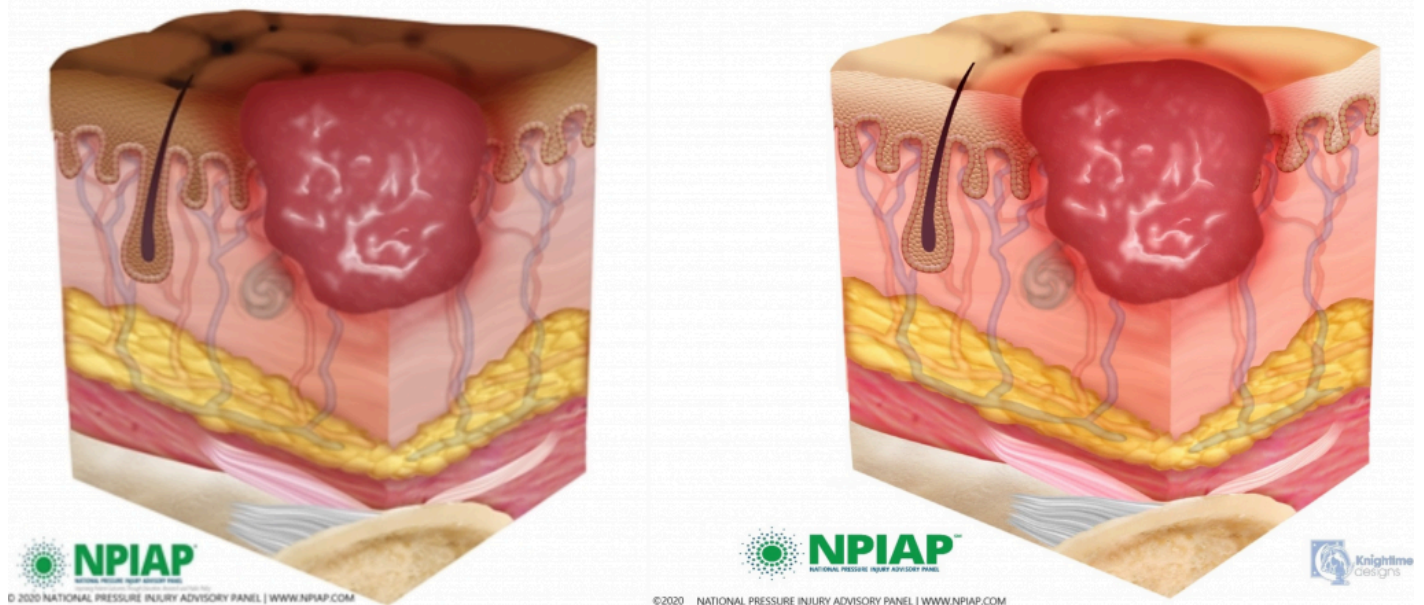


Figure 10.16 Stage 2 Pressure Injury. Used with permission.

Stage 3 Pressure Injuries

Stage 3 pressure injuries are full-thickness tissue loss in which fat is visible, but cartilage, tendon, ligament, muscle, and bone are not exposed. The depth of tissue damage varies by anatomical location. Because the wound extends through all skin layers, there is increased risk of infection in Stage 3 pressure injuries. There may be pus draining from the wound, tissue necrosis, pain, or

11. Richardson, C. (2023). *Stage 2 pressure ulcer: Symptoms and treatment*. <https://www.medicalnewstoday.com/articles/stage-2-pressure-ulcer-symptoms-and-treatment>

12. “20201202_114031_31850.jpg” and “stage_2_april_2020.jpg” provided by [National Pressure Injury Advisory Panel](https://npiap.com/page/PressureInjuryStages) are used with permission for educational purposes. Access for free at <https://npiap.com/page/PressureInjuryStages>.

fever, especially in the presence of an infection.¹³ See Figure 10.17¹⁴ for an illustration of a Stage 3 pressure injury.

Undermining and tunneling may occur in Stage 3 and 4 pressure injuries. **Undermining** occurs when the tissue under the wound edge becomes eroded, resulting in a pocket beneath the skin. **Tunneling** refers to passageways underneath the skin surface that extend from a wound and can take twists and turns.

Slough and eschar may also be present in Stage 3 and 4 pressure injuries. Slough is inflammatory exudate that is usually light yellow, soft, and moist. **Eschar** is dark brown/black, dry, thick, and leathery dead tissue. If slough or eschar obscures the wound so that tissue loss cannot be assessed, the pressure injury is referred to as unstageable.¹⁵ In most wounds, slough and eschar must be removed by debridement for accurate wound staging and for healing to occur. Removal of slough or eschar is surgically performed by specially trained health care providers. Nurses may apply prescribed chemical debridement agents or wet-to-dry dressings for mechanical debridement per provider orders.

13. Richardson, C. (2023). *Stage 2 pressure ulcer: Symptoms and treatment*. <https://www.medicalnewstoday.com/articles/stage-2-pressure-ulcer-symptoms-and-treatment>

14. “20201202_114132_23541.jpg” and “stage_3_april_2020.jpg” provided by [National Pressure Injury Advisory Panel](#) are used with permission for educational purposes. Access for free at <https://npiap.com/page/PressureInjuryStages>

15. Davis, C. P. Normal flora. (1996). In S. Baron (Ed.), *Medical Microbiology* (4th ed.). University of Texas Medical Branch at Galveston. <https://www.ncbi.nlm.nih.gov/books/NBK7617/>

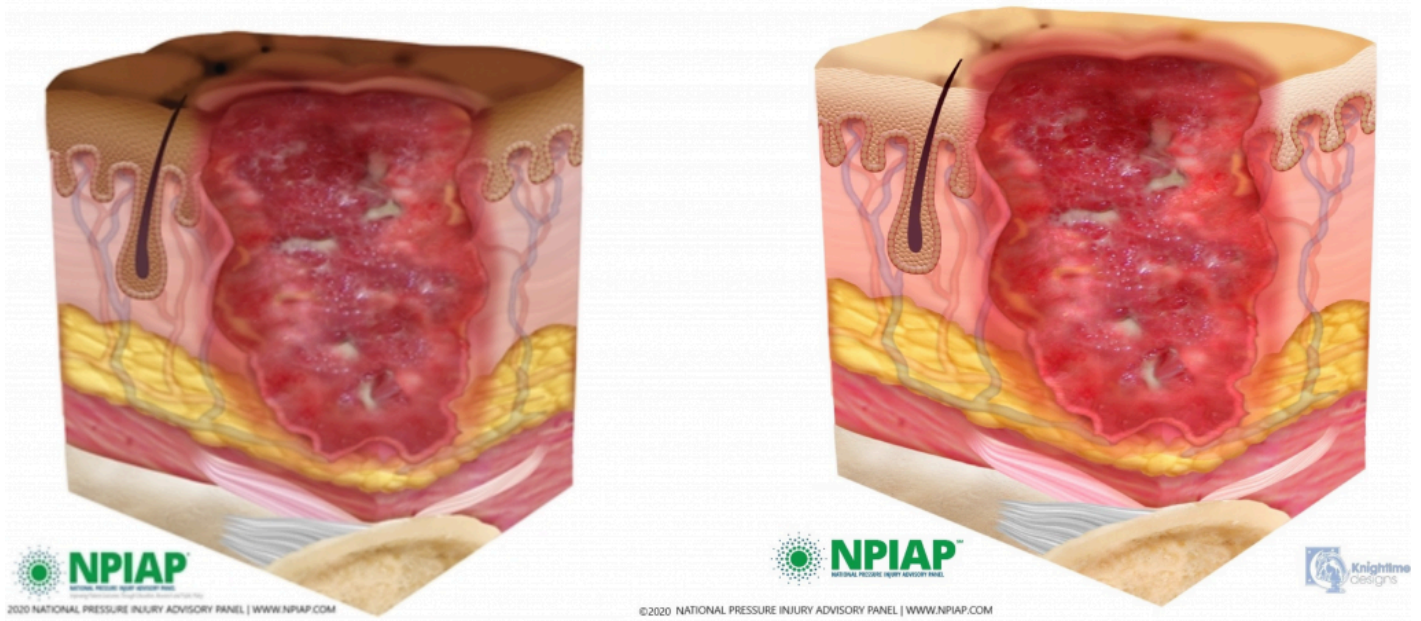


Figure 10.17 Stage 3 Pressure Injury. Used with permission.

Stage 4 Pressure Injuries

Stage 4 pressure injuries are full-thickness tissue loss, like in Stage 3 pressure injuries, but also have exposed cartilage, tendon, ligament, muscle, or bone. Stage 4 pressure injuries are at an increased risk of infection because their depth goes through all skin layers. There may be pain associated with Stage 4 pressure ulcers, although they are often less painful because the wound damages nerve endings. There may also be firm or mushy texture at the site, discoloration, or necrosis to the wound. Because the wound often extends to the bone, thus exposing the bone to infectious agents in the environment, osteomyelitis (bone infection) may also be present. Osteomyelitis is a serious

bone infection that may require amputation or cause death if not promptly treated aggressively with antibiotics.^{16,17}

See Figure 10.18¹⁸ for an illustration of a Stage 4 pressure injury.

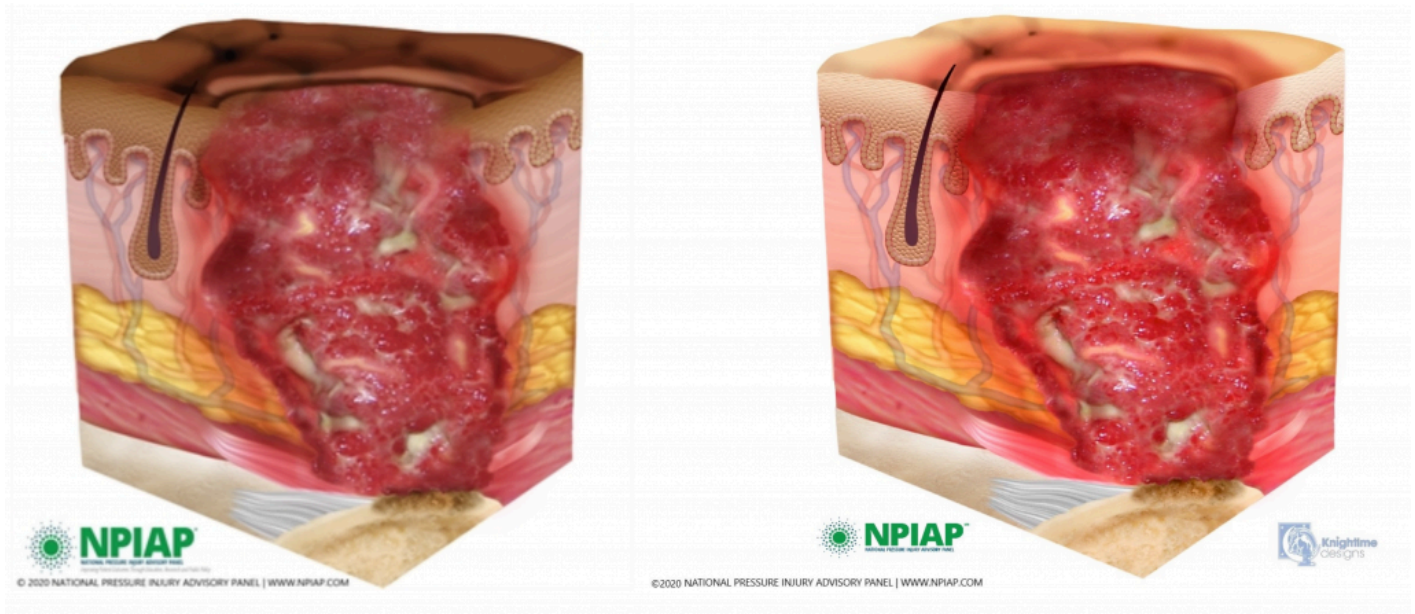


Figure 10.18 Stage 4 Pressure Injury. Used with permission.

16. Edsberg, L. E., Black, J. M., Goldberg, M., McNichol, L., Moore, L., & Sieggreen, M. (2016). Revised national pressure ulcer advisory panel pressure injury staging system: Revised pressure injury staging system. *Journal of Wound, Ostomy, and Continence Nursing: Official Publication of The Wound, Ostomy and Continence Nurses Society*, 43(6), 585–597. <https://doi.org/10.1097/WON.0000000000000281>
17. Momodu, I. I., & Savaliya, V. (2023). Osteomyelitis. [Updated 2023 May 31]. In: StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK532250/>
18. “20201202_114459_31029.jpg” and “stage_4_april_2020.jpg” provided by [National Pressure Injury Advisory Panel](https://npiap.com/page/PressureInjuryStages) are used with permission for educational purposes. Access for free at <https://npiap.com/page/PressureInjuryStages>

- ▶ View images of different stages of pressure injuries on people with dark skin tones on the [PPPIA Pressure Ulcers in People With Dark Skin Tones poster](#).

Unstageable Pressure Injuries

Unstageable pressure injuries are full-thickness skin and tissue loss in which the extent of tissue damage within the ulcer cannot be confirmed because it is obscured by slough or eschar. If slough or eschar were to be removed, a Stage 3 or Stage 4 pressure injury would likely be revealed. However, dry and adherent eschar on the heel or ischemic limb is not typically removed.¹⁹ See Figure 10.19²⁰ for an illustration of an unstageable pressure ulcer due to the presence of eschar (on the left side of the wound) and slough (on the right side of the wound).

19. U.S. National Library of Medicine. (2022). *Stasis dermatitis and ulcers: Medlineplus medical encyclopedia*. MedlinePlus. <https://medlineplus.gov/ency/article/000834.htm>

20. “Unstageable- Darkly Pigmented_Skin.jpg” and “unstageable-halfslough__1.jpg” provided by [National Pressure Injury Advisory Panel](#) are used with permission for educational purposes. Access for free at <https://npiap.com/page/PressureInjuryStages>

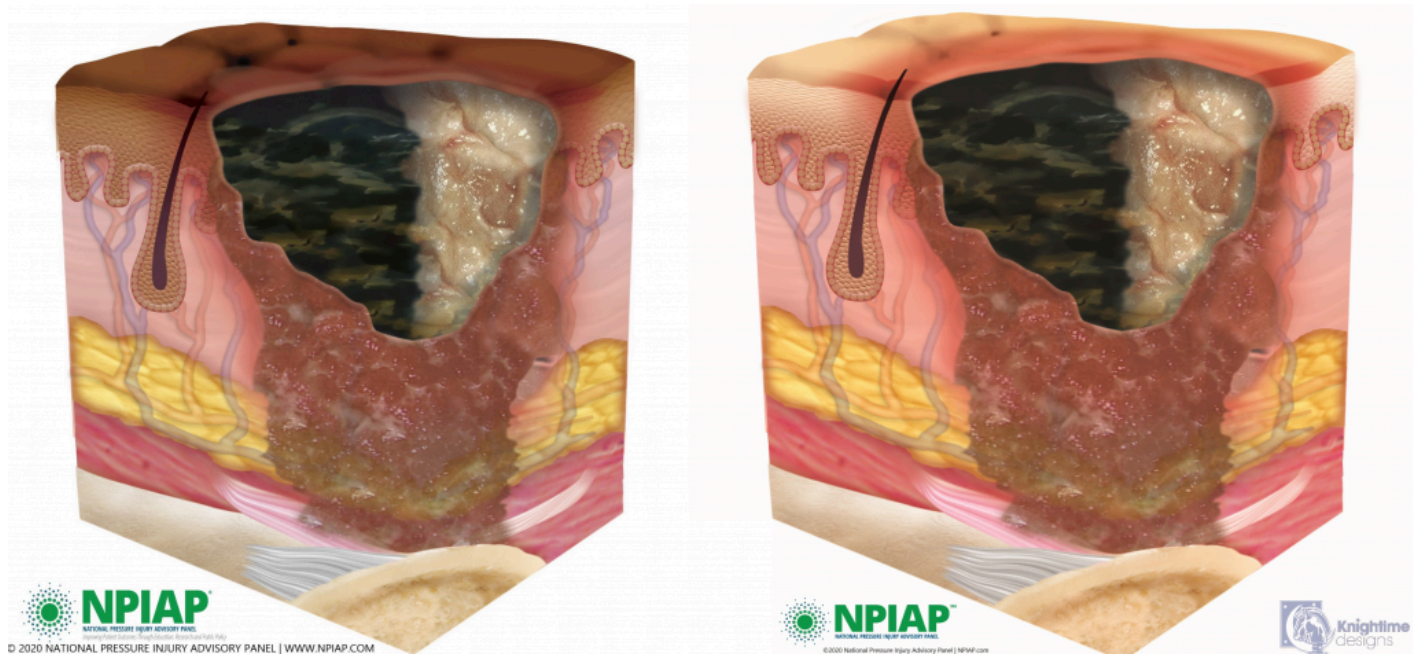


Figure 10.19 Unstageable Pressure Injury. Used with permission.

Deep Tissue Pressure Injuries

Deep tissue pressure injuries consist of persistent nonblanchable and deep red, maroon, or purple discoloration of an area. These discolorations typically reveal a dark wound bed or blood-filled blister. Be aware that the discoloration may appear differently in darkly pigmented skin. Deep tissue injury results from intense and/or prolonged pressure, as well as shear forces at the bone-muscle interface. The wound may evolve rapidly to reveal the

actual extent of tissue injury, or it may resolve without tissue loss.^{21, 22} See Figure 10.20 for an illustration of a deep tissue injury.

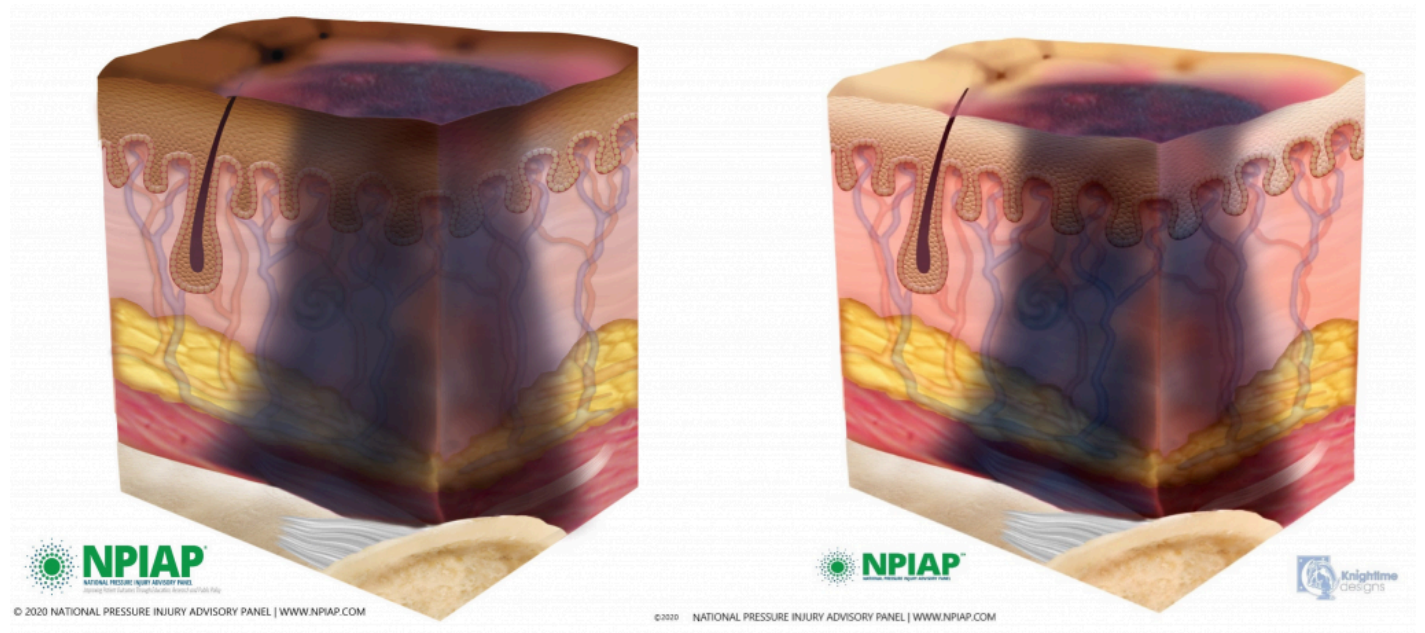


Figure 10.20 Deep Tissue Pressure Injury

21. Edsberg, L. E., Black, J. M., Goldberg, M., McNichol, L., Moore, L., & Sieggreen, M. (2016). Revised national pressure ulcer advisory panel pressure injury staging system: Revised pressure injury staging system. *Journal of Wound, Ostomy, and Continence Nursing: Official Publication of The Wound, Ostomy and Continence Nurses Society*, 43(6), 585–597. <https://doi.org/10.1097/WON.0000000000000281>
22. “DTPI-Darkly Pigmented Skin” and “deep_tissue_pressure_injury_.jpg” provided by [National Pressure Injury Advisory Panel](https://npiap.com) are used with permission for educational purposes. Access for free at <https://npiap.com/page/PressureInjuryStages>

Video Review of Assessing Pressure Injuries²³



One or more interactive elements has been excluded from this version of the text. You can view them online here: <https://wtcs.pressbooks.pub/nursingfundamentals/?p=566#oembed-1>

23. RegisteredNurseRN. (2018, March 7). *Pressure ulcers (injuries) stages, prevention, assessment / Stage 1, 2, 3, 4 unstageable NCLEX* [Video]. YouTube. All rights reserved. Video used with permission.
<https://youtu.be/MDtPik1UE6k>

10.5 Braden Scale

OPEN RESOURCES FOR NURSING (OPEN RN)

Several factors place a client at risk for developing a pressure injury, in addition to shear and friction. These factors include decreased sensory perception, increased moisture, decreased activity, impaired mobility, and inadequate nutrition. The **Braden Scale** is a standardized, evidence-based assessment tool commonly used in health care to assess and document a client's risk for developing pressure injuries. See Figure 10.21¹ for an image of a Braden Scale. Risk factors are rated on a scale from 1 to 4, with 1 being “completely limited” and 4 being “no impairment.” The scores from the six categories are added, and the total score indicates a client's risk for developing a pressure injury based on these ranges:

- Mild risk: 15-18
- Moderate risk: 13-14
- High risk: 10-12
- Severe risk: less than 9

1. This work is derivative of the “Braden Scale” by Prevention Plus. Used under Fair Use. Access for free at https://www.in.gov/core/results.html?collection=global-collection&profile=_default&query=braden+scale

BRADEN SCALE FOR PREDICTING PRESSURE SORE RISK

Patient's Name _____		Evaluator's Name _____			Date of Assessment _____						
SENSORY PERCEPTION ability to respond meaningfully to pressure-related discomfort	1. Completely Limited Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation. OR limited ability to feel pain over most of body	2. Very Limited Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness OR has a sensory impairment which limits the ability to feel pain or discomfort over 1/2 of body.	3. Slightly Limited Responds to verbal commands, but cannot always communicate discomfort or the need to be turned. OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	4. No Impairment Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.							
MOISTURE degree to which skin is exposed to moisture	1. Constantly Moist Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	2. Very Moist Skin is often, but not always moist. Linen must be changed at least once a shift.	3. Occasionally Moist: Skin is occasionally moist, requiring an extra linen change approximately once a day.	4. Rarely Moist Skin is usually dry, linen only requires changing at routine intervals.							
ACTIVITY degree of physical activity	1. Bedfast Confined to bed.	2. Chairfast Ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	3. Walks Occasionally Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair	4. Walks Frequently Walks outside room at least twice a day and inside room at least once every two hours during waking hours							
MOBILITY ability to change and control body position	1. Completely Immobile Does not make even slight changes in body or extremity position without assistance	2. Very Limited Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	3. Slightly Limited Makes frequent though slight changes in body or extremity position independently.	4. No Limitation Makes major and frequent changes in position without assistance.							
NUTRITION <u>usual</u> food intake pattern	1. Very Poor Never eats a complete meal. Rarely eats more than 1/2 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement OR is NPO and/or maintained on clear liquids or IV's for more than 5 days.	2. Probably Inadequate Rarely eats a complete meal and generally eats only about 1/2 of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement. OR receives less than optimum amount of liquid diet or tube feeding	3. Adequate Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products per day. Occasionally will refuse a meal, but will usually take a supplement when offered OR is on a tube feeding or TPN regimen which probably meets most of nutritional needs	4. Excellent Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.							
FRICITION & SHEAR	1. Problem Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures or agitation leads to almost constant friction	2. Potential Problem Moves feebly or requires minimum assistance. During a move skin probably slides to some extent against sheets, chair, restraints or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	3. No Apparent Problem Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair.								
© Copyright Barbara Braden and Nancy Bergstrom, 1988 All rights reserved				Total Score							

Figure 10.21 Braden Scale

How to Score the Braden Scale

Each risk factor on the Braden Scale is rated from 1 to 4 based on the client's assessment findings. When using the Braden Scale, start with the first category and review each description listed across the row for each of the ratings from 1 to 4, and choose the one that best describes the client's current status. Continue this process for all rows. Add all six numbers to determine a total score, and then use the total score to determine if the client is at mild, moderate, high, or severe risk for developing a pressure injury. The lower the score, the higher the risk of developing a pressure injury. Additionally,

customized nursing interventions are implemented based on the rating in each category. The lower the score, the more aggressive actions are taken to prevent or heal a pressure injury. Descriptions of the ratings from 1-4 for each risk factor, along with targeted interventions for each rating, are further described in the following subsections.

Sensory Perception

The sensory perception risk factor is defined as the ability to respond meaningfully to pressure-related discomfort. If a client is unable to feel pressure-related discomfort and respond to it appropriately by moving or reporting pain, they are at high risk of developing a pressure injury. This risk category describes two different issues that affect sensory perception. The first description refers to the client's level of consciousness, and the second description refers to the client's ability to feel cutaneous sensation. See Table 10.5a for a description of each level of risk from 1-4 with associated interventions for each level.²

Table 10.5a Descriptions and Interventions by Level of Risk for Sensory Perception

2. Agency for Healthcare Research and Quality. (2014). *Preventing pressure ulcers in hospitals*. <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

Assessment Category	Rating Description	Interventions
Sensory Perception	<p>4–No Impairment</p> <p>Responds to verbal commands. Has no sensory deficit that would limit ability to feel or voice pain or discomfort.</p>	<ul style="list-style-type: none"> • Encourage the client to report pain over bony prominences. • Check heels daily.
Sensory Perception	<p>3–Slightly Limited</p> <p>Responds to verbal commands but cannot always communicate discomfort or the need to be turned.</p> <p>OR</p> <p>Has some sensory impairment that limits ability to feel pain or discomfort in 1 or 2 extremities.</p>	<ul style="list-style-type: none"> • Assess and inspect skin every shift. Pay attention to heels. • Elevate heels and use protectors.
Sensory Perception	<p>2–Very Limited</p> <p>Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness.</p> <p>OR</p> <p>Has a sensory impairment that limits the ability to feel pain or discomfort over half of the body.</p>	<p>All interventions mentioned in 3–Slightly Limited plus:</p> <ul style="list-style-type: none"> • Consider specialty mattress or bed.
Sensory Perception	<p>1–Completely Limited</p> <p>Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation.</p> <p>OR</p> <p>Limited ability to feel pain over most of the body.</p>	<p>All interventions mentioned in 2–Very Limited plus:</p> <ul style="list-style-type: none"> • Use pillows between knees and bony prominences to avoid direct contact.

Moisture

The moisture risk factor is defined as the degree to which skin is exposed to moisture. Prolonged exposure to moisture increases the probability of skin breakdown. Moisture can come from several sources, such as perspiration, urine incontinence, stool incontinence, or wound drainage. Frequent surveillance, removal of wet or soiled linens, and use of protective skin barriers greatly reduce this risk factor. See Table 10.5b for specific interventions for each level of risk.³

Table 10.5b Interventions by Level of Risk for Moisture

3. Agency for Healthcare Research and Quality. (2014). *Preventing pressure ulcers in hospitals*. <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

	Rating Description	Interventions
Moisture	<p>4–Rarely Moist</p> <p>Skin is usually dry; linen only requires changing at routine intervals.</p>	<ul style="list-style-type: none"> • Encourage the client to use lotion to prevent skin cracks. • Encourage the client to report any moisture problem (such as under breasts).
Moisture	<p>3–Occasionally Moist</p> <p>Skin is occasionally moist, requiring an extra linen change approximately once per day.</p>	<p>All interventions mentioned in 4–Rarely Moist plus:</p> <ul style="list-style-type: none"> • Use moisture barrier ointments (protective skin barriers). • Moisturize dry unbroken skin. • Avoid hot water. Use mild soap and soft cloths or packaged cleanser wipes. • Routinely check incontinence pads. • Avoid use of adult diapers but if necessary, check frequently (every 2-3 hours) and change as needed. • If stool incontinence, consider bowel training and toileting after meals.
Moisture	<p>2–Often Moist</p> <p>Skin is often but not always moist. Linen must be changed at least once per shift.</p>	<p>All interventions mentioned in 3–Occasionally Moist plus:</p> <ul style="list-style-type: none"> • Check incontinence pads frequently (every 2-3 hours). • Consider a low air loss bed.

Moisture	1–Constantly Moist Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time the client is moved or turned.	All interventions mentioned in 2–Often Moist plus: <ul style="list-style-type: none"> • Assess and inspect skin every shift. • Check incontinence pads frequently (every 2-3 hours) and change as needed. • Apply condom catheter if appropriate. • If stool incontinence, consider bowel training and toileting after meals or rectal tubes if appropriate.
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Activity

The activity risk factor is defined as the degree of physical activity. For example, walking or moving from a bed to a chair reduces a client’s risk of developing a pressure injury by redistributing pressure points and increasing blood and oxygen flow to areas at risk.

Level of activity is defined by how frequently the client is able to get out of bed, move into a chair, or ambulate with or without help. See Table 10.5c for a description of each level of risk from 1-4 with associated interventions for each.⁴

Table 10.5c Descriptions and Interventions by Level of Risk for Activity⁵

4. Agency for Healthcare Research and Quality. (2014). *Preventing pressure ulcers in hospitals*. <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

5. Agency for Healthcare Research and Quality. (2014). *Preventing pressure ulcers in hospitals*. <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

Assessment Category	Rating Description	Interventions
Activity	<p>4–Walks Frequently</p> <p>Walks outside the room at least twice a day and inside the room at least once every two hours during waking hours.</p>	<ul style="list-style-type: none"> • Encourage ambulation outside the room. • Check skin daily. • Monitor balance and endurance.
Activity	<p>3–Walks Occasionally</p> <p>Walks occasionally during the day, but for very short distances, with or without assistance. Spends the majority of each shift in bed or chair.</p>	<ul style="list-style-type: none"> • Provide a structured mobility plan. • Consider a chair cushion. • Consider physical therapy consult.

<p>Activity</p>	<p>2–Chair Fast</p> <p>Ability to walk is severely limited or nonexistent. Cannot bear their own weight and/or must be assisted into chair or wheelchair.</p>	<ul style="list-style-type: none"> • Consider a specialty chair pad. • Consider postural alignment, weight distribution, balance, stability, and pressure relief when positioning individuals in chairs or wheelchairs. • Instruct the client to reposition every 15 minutes when in the chair. • Stand every hour. • Pad bony prominences with foam wedges, rolled blankets, or towels. • Consider physical therapy consult for conditioning and wheelchair assessment.
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Activity	1-Bedfast Confined to bed.	<ul style="list-style-type: none"> • Perform skin assessment and inspection every shift. • Position prone if appropriate or elevate head of bed no more than 30 degrees. • Position with pillows to elevate pressure points off the bed. • Consider specialty beds. • Elevate heels off bed and/or use heel protectors. • Consider physical therapy consult for conditioning and wheelchair assessment. • Turn/reposition every 1-2 hours. • Post turning schedule. • Teach or do frequent small shifts of body weight.
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Mobility

The mobility risk factor is defined as the client's ability to change or control their body position. For example, healthy people frequently change body position by rolling over in bed, shifting weight in a chair after sitting too long, or by moving their extremities. However, tissue damage will occur if a client is

unable to reposition on their own power unless caregivers frequently change their position. See Table 10.5d for interventions for each level of risk from 1-4.⁶

Table 10.5d Interventions by Level of Risk for Mobility⁷

6. Agency for Healthcare Research and Quality. (2014). *Preventing pressure ulcers in hospitals*. <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

7. Agency for Healthcare Research and Quality. (2014). *Preventing pressure ulcers in hospitals*. <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

Assessment Category	Rating Description	Interventions
Mobility	4–No Limitations Makes major and frequent changes in position without assistance.	<ul style="list-style-type: none"> • Check skin daily. • Encourage ambulation outside the room at least twice daily. • No interventions required.
Mobility	3–Slightly Limited Makes frequent though slight changes in body or extremity position independently.	<ul style="list-style-type: none"> • Check skin daily. • Turn/reposition frequently. • Teach frequent small shifts of body weight. • Consult physical therapy for strengthening/conditioning. • Use a gait belt for assistance.

Mobility	2–Very Limited Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	<ul style="list-style-type: none"> • Perform skin assessment and inspection every shift. • Turn/reposition 1-2 hours. • Post turning schedule. • Teach or do frequent small shifts of body weight. • Elevate heels. • Consider a specialty bed.
Mobility	1-Completely Immobile Does not make even slight changes in body or extremity position without assistance.	Same interventions as for 2–Very Limited

Nutrition

Adequate nutrition and fluid intake are vital for maintaining healthy skin. Protein intake, in particular, is very important for healthy skin and wound healing. The nutrition risk factor is defined by two categories of descriptions. The first category measures the amount and type of oral intake. The second category is used for clients receiving tube feeding, total parenteral nutrition (TPN), or are prescribed clear liquid diets or nothing by mouth (NPO). See Table 10.5e for interventions for each level of risk from 1-4.⁸

8. Agency for Healthcare Research and Quality. (2014). *Preventing pressure ulcers in hospitals*. <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

Table 10.5e Interventions by Level of Risk for Nutrition⁹

9. Agency for Healthcare Research and Quality. (2014). *Preventing pressure ulcers in hospitals*. <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

Assessment Category	Rating Description	Interventions
Nutrition	<p>4–Excellent</p> <p>Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.</p>	<ul style="list-style-type: none"> • Move the client out of bed for all meals. • Provide food choices. • Offer nutrition supplements. • Discuss a plan with the provider if the client is NPO for greater than 24 hours. • Record dietary intake.
Nutrition	<p>3–Adequate</p> <p>Eats over half of most meals. Eats a total of 4 servings of protein (meat and dairy products) each day. Occasionally refuses a meal, but will take a supplement if offered</p> <p style="text-align: center;">OR</p> <p>Is on a tube feeding or TPN regimen that most likely meets most of nutritional needs</p>	<ul style="list-style-type: none"> • Observe and monitor nutritional intake. • Discuss a plan with the provider if the client is NPO for greater than 24 hours. • Record dietary intake and I&O if appropriate.

<p>Nutrition</p>	<p>2–Probably Inadequate</p> <p>Rarely eats a complete meal and generally eats only about half of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dairy supplement</p> <p>OR</p> <p>Receives less than optimum amount of liquid diet or tube feeding.</p>	<p>All interventions mentioned in 3–Adequate plus:</p> <ul style="list-style-type: none"> • Encourage fluid intake as appropriate. • Obtain nutritional/ dietary consult. • Offer nutrition supplements and water. • Encourage family to bring favorite foods. • Provide small, frequent meals.
<p>Nutrition</p>	<p>1–Very Poor</p> <p>Never eats a complete meal. Rarely eats more than one third of any food offered. Eats two servings of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement</p> <p>OR</p> <p>Is NPO and/or maintained on clear liquids or IV for more than 5 days.</p>	<p>All interventions mentioned in 2–Probably Inadequate plus:</p> <ul style="list-style-type: none"> • Perform skin assessment and inspection every shift.

Friction/Shear

Friction and shear are significant risk factors for producing pressure injuries. This category only has three ratings, unlike the other categories that have four ratings, and is rated by whether the client has a problem, potential problem, or no apparent problem in this area. See Table 10.5f for interventions for each level of risk.¹⁰

10. Agency for Healthcare Research and Quality. (2014). *Preventing pressure*

Table 10.5f Descriptions and Interventions by Level of Risk for Friction/Shear¹¹

ulcers in hospitals. <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

11. Agency for Healthcare Research and Quality. (2014). *Preventing pressure ulcers in hospitals.* <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

Assessment Category	Rating Description	Interventions
Friction/Shear	<p>3–No Apparent Problem</p> <p>Moves in bed and chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.</p>	<p>Keep bed linens clean, dry, and wrinkle free.</p>
Friction/Shear	<p>2–Potential Problem</p> <p>Moves feebly or requires minimal assistance. During a move, skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains a relatively good position in a chair or bed most of the time but occasionally slides down.</p>	<p>All interventions mentioned in 3–No Apparent Problem plus:</p> <ul style="list-style-type: none"> • Avoid massaging pressure points. • Apply transparent dressing or elbow/heel protectors to intact skin over elbows and heels.

Friction/Shear	1–Problem Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.	All interventions mentioned in 2–Potential Problem plus: <ul style="list-style-type: none"> • Perform skin assessment and inspection every shift. • Use a minimum of two people assisting plus a draw sheet in pulling the client up in bed. • Keep bed linens clean, dry, and wrinkle free. • Apply elbow/heel protectors to intact skin over elbows and heels. • Elevate head of bed 30 degrees or less to reduce shear when feasible.
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Team Member Roles to Prevent Pressure Injuries

Each member of the health care team has an important role in preventing the development of pressure injuries in at-risk clients. A registered nurse can delegate many interventions for preventing and treating a pressure injury to a licensed practical nurse (LPN) or to unlicensed assistive personnel such as a certified nursing assistant (CNA). See Table 10.5g for an explanation of the role of the RN in preventing pressure injuries, as well as tasks that can be delegated to LPNs and CNAs.

Table 10.5g Team Member Roles in Preventing Pressure Injuries¹²

12. Agency for Healthcare Research and Quality. (2014). *Preventing pressure*

ulcers in hospitals. <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html#Tool3B>

Role	Tasks
RN	<ul style="list-style-type: none"> • Conducts or supervises accurate assessment and documentation of head-to-toe skin assessment and pressure injury risk (Braden Scale or Braden Risk Assessment) on admission, daily, and if condition deteriorates (or according to facility policy) • Documents care plan tied to identified risk: <ul style="list-style-type: none"> ◦ Sensory perception ◦ Moisture ◦ Activity ◦ Mobility ◦ Nutrition ◦ Friction/Shear • Performs or supervises performance of care plan procedures or treatments • Collaborates with other staff to ensure timely and accurate reporting of any skin issues • Notifies wound nurse of any skin conditions or high-risk clients • Notifies physician of any skin problems • Educates client/family about risk factors
LPN	<ul style="list-style-type: none"> • Conducts accurate assessment and documentation of head-to-toe skin assessment and pressure injury risk (Braden Scale) on admission, daily, and if condition deteriorates (or according to facility policy) • Documents care plan tied to identified risk: <ul style="list-style-type: none"> ◦ Sensory perception ◦ Moisture ◦ Activity ◦ Mobility ◦ Nutrition ◦ Friction/Shear • Performs care for risk as needed • Informs RN of any skin issues

CNA

- Checks skin each time person is turned or cleaned or bed is changed
- Reports any skin issues to nurse
- Turns/repositions client as ordered
- Offers liquids each time in room
- Keeps skin clean and reapplies protective skin barrier
- Applies products (lotion, cream, skin sealant, etc.) as needed

10.6 Applying the Nursing Process

OPEN RESOURCES FOR NURSING (OPEN RN)

Assessment

Subjective Assessment

During a subjective assessment of a client's integumentary system, begin by asking about current symptoms such as itching, rashes, or wounds. If a client has a wound, it is important to determine if a client has pain associated with the wound so that pain management can be implemented. For clients with chronic wounds, it is also important to identify factors that delay wound healing, such as nutrition, decreased oxygenation, infection, stress, diabetes, obesity, medications, alcohol use, and smoking.¹ See Table 10.6a for a list of suggested interview questions to use when assessing a client with a wound.

If a client has a chronic wound or is experiencing delayed wound healing, it is important for the nurse to assess the impact of the wound on their quality of life. Reasons for this may include the frequency and regularity of dressing changes, which affect daily routine; a feeling of continued fatigue due to lack of sleep; restricted mobility; pain; odor; and the side effects of multiple medications. The loss of independence associated with functional decline can also lead to changes in overall health and well-being. These changes include altered eating habits, depression, social isolation, and a gradual reduction in activity levels.

Table 10.6a Interview Questions Related to Integumentary Disorders

1. Grey, J. E., Enoch, S., & Harding, K. G. (2006). Wound assessment. *BMJ (Clinical research ed.)*, 332(7536), 285–288. <https://doi.org/10.1136/bmj.332.7536.285>

Symptoms	Questions	Follow-up Questions
Current Symptoms	Are you currently experiencing any skin symptoms such as itching, rashes, or an unusual mole?	Please describe.
Wounds	<p>Do you have any current wounds such as a surgical incision, skin tear, arterial ulcer, venous ulcer, diabetic or neuropathic ulcer, or a pressure injury?</p> <p>If a wound is present:</p> <ul style="list-style-type: none"> • Is the wound painful? • Do you have any symptoms of infection in the wound, such as increased redness, drainage, warmth, or tenderness around the wound? 	<p>Please describe.</p> <p>Use the PQRSTU method to comprehensively assess pain. Read more about the PQRSTU method in the “Pain Assessment Methods” section of the “Comfort” chapter.</p>
Medical History	Have you ever been diagnosed with a wound related to diabetes, heart disease, or peripheral vascular disease?	Please describe.
If chronic wounds or wounds with delayed healing are present:		
Medications	Are you taking any medications that can affect wound healing, such as oral steroids to treat inflammation or help you breathe?	Please describe.
Treatments	What have you used to try to treat this wound?	What was successful? Unsuccessful?

Symptoms of Infection (pain, purulent drainage, etc.)	Are you experiencing any symptoms of infection related to this wound such as increased pain or yellow/green drainage?	Please describe.
Stress	Have you experienced any recent stressors such as surgery, hospitalization, or a change in life circumstances?	How do you cope with stress in your life?
Smoking	Do you smoke?	How many cigarettes do you smoke a day? How long have you smoked? Have you considered quitting smoking?
Quality of Life	Has this wound impacted your quality of life?	Have you had any changes in eating habits, feelings of depression or social isolation, or a reduction in your usual activity levels?

Objective Assessment

When performing an objective integumentary assessment on a client receiving inpatient care, it is important to perform a thorough exam on admission to check for existing wounds, as well as to evaluate their risk of skin breakdown using the Braden Scale. Agencies are not reimbursed for care of pressure injuries received during a client's stay, so existing wounds on admission must be well-documented. Routine skin assessment should continue throughout a client's stay, usually on a daily or shift-by-shift basis based on the client's condition. If a wound is present, it is assessed during every dressing change for signs of healing. See Table 10.6b for components to include in a wound assessment. See Figure 10.22² for an image of a common tool used to document the location of a skin concern found during assessment.

2. "putool7bfig.jpg" by unknown is licensed under [CC0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/putool7b.html>.

- ▶ Read more information about performing an overall integumentary assessment in the “[Integumentary Assessment](#)” chapter in *Open RN Nursing Skills, 2e*.
- ▶ For additional discussion regarding assessing wounds, go to the “[Assessing Wounds](#)” section of the “Wound Care” chapter in *Open RN Nursing Skills, 2e*.
- ▶ There are many common skin disorders that a nurse may find during assessment. Read more about common skin disorders in the “[Common Integumentary Conditions](#)” section of the “Integumentary Assessment” chapter in *Open RN Nursing Skills, 2e*.

Table 10.6b Wound Assessment

Wound Assessment	
Type	Types of wounds may include abrasions, lacerations, burns, surgical incisions, pressure injuries, skin tears, arterial ulcers, or venous ulcers. It is important to understand the type of wound present to select appropriate interventions.
Location	The location of the wound should be documented precisely. A body diagram template is helpful to demonstrate exactly where the wound is located.
Size	Wound size should be measured regularly to determine if the wound is increasing or decreasing in size. 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 method.
Degree of Tissue Injury	<p>Wounds are classified as partial-thickness (meaning the epidermis and dermis are affected) or full-thickness (meaning the subcutaneous and deeper layers are affected). See Figure 10.1 in the "Basic Concepts" section for an image of the layers of skin.</p> <p>For pressure injuries, it is important to assess the stage of the injury (see information on staging in the "Pressure Injuries" section).</p>
Color of Wound Base	Assess the base of the wound for the presence of healthy, pink/red granulation tissue. Note the unhealthy appearance of dark red granulation tissue, white or yellow slough, or brown or black necrotic tissue.

Drainage	<p>The color, consistency, and amount of exudate (drainage) should be assessed and documented at every dressing change. Drainage from wounds is often described as scant, small/minimal, moderate, and large/copious amounts. Use the following descriptions to select the appropriate terms:³</p> <ul style="list-style-type: none"> • No exudate present: The wound base is dry. • Scant amount of exudate present: The wound is moist, but no measurable amount of exudate appears on the dressing. • Minimal amount of exudate on the dressing: Exudate covers less than 25% of the bandage. • Moderate amount of drainage: Wound tissue is wet, and drainage covers 25% to 75% of the bandage. • Large or copious amount of drainage: Wound tissue is filled with fluid and exudate covers more than 75% of the bandage. <p>The type of wound drainage should be described using medical terms such as serosanguinous, sanguineous, serous, or purulent:</p> <ul style="list-style-type: none"> • Sanguineous: Sanguineous exudate is fresh bleeding.⁴ • Serous: Serous drainage is clear, thin, watery plasma. It's normal during the inflammatory stage of wound healing, and small amounts are considered normal wound drainage.⁵ • Serosanguineous: Serosanguineous exudate contains serous drainage with small amounts of blood present.⁶ • Purulent: Purulent exudate is thick and opaque. It can be tan, yellow, green, or brown in color. It is never considered normal in a wound bed, and new purulent drainage should always be reported to the health care provider.⁷ See Figure 10.23⁸ for an image of purulent drainage.
Tubes or Drains	<p>Check for patency and if they are attached correctly.</p>

3. Wound Care Advisor. (n.d.). *Exudate amounts*. <https://woundcareadvisor.com/exudate-amounts/#:~:text=Small%20or%20minimal%20amount%20of,than%2075%25%20of%20the%20bandage>

Signs and Symptoms of Infection	Assess for signs and symptoms of infection, which include the following: <ul style="list-style-type: none"> • Redness • Warmth of surrounding tissue • Swelling • Tenderness or pain • Purulent drainage • Fever • Increased white blood cell count
Wound Edges and Periwound	Assess the surrounding skin for maceration or signs of infection.
Pain	Assess for pain in the wound or during dressing changes. If pain is present, use the PQRSTU or OLDCARTES method to obtain a comprehensive pain assessment.

4. Wound Care Advisor. (n.d.). *Wound exudate types*. <https://woundcareadvisor.com/wound-exudate-types/#:~:text=Serous%20drainage%20is%20clear%2C%20thin,may%20indicate%20a%20high%20bioburden>
5. Wound Care Advisor. (n.d.). *Wound exudate types*. <https://woundcareadvisor.com/wound-exudate-types/#:~:text=Serous%20drainage%20is%20clear%2C%20thin,may%20indicate%20a%20high%20bioburden>
6. Wound Care Advisor. (n.d.). *Wound exudate types*. <https://woundcareadvisor.com/wound-exudate-types/#:~:text=Serous%20drainage%20is%20clear%2C%20thin,may%20indicate%20a%20high%20bioburden>
7. Wound Care Advisor. (n.d.). *Wound exudate types*. <https://woundcareadvisor.com/wound-exudate-types/#:~:text=Serous%20drainage%20is%20clear%2C%20thin,may%20indicate%20a%20high%20bioburden>
8. “Purulent knee aspirate.JPG” by James Heilman, MD is licensed under [CC BY 3.0](https://creativecommons.org/licenses/by/3.0/)

PRESSURE ULCER IDENTIFICATION POCKET PAD

Place the patient's/resident's name on the top of the pad, date it and place an "X" on the area on the body where you see the skin concern. Give this to the nurse and ask him or her to check the patient/resident. They will follow up as needed.

Date: _____ Time: _____

Patient's/Resident's Name: _____

Reporter: _____

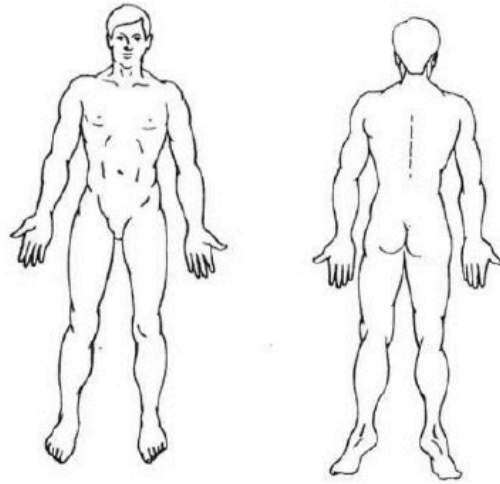


Figure 10.22 Skin Concern Documentation



*Figure 10.23
Purulent
Drainage*

See Table 10.6c for a comparison of expected versus unexpected findings on integumentary assessment.

Table 10.6c Expected Versus Unexpected Findings

Assessment	Expected Findings	Unexpected Findings
Skin	Color: appropriate for ethnicity Temperature: warm to touch Texture: smooth, soft, and supple Turgor: resilient Integrity: no wounds or lesions noted Sensory: no pain or itching noted	Color: pale, white, red, yellow, purple, black and blue Temperature: cool or hot to touch Texture: rough, scaly or thick; thin and easily torn; dry and cracked Turgor: tenting noted Integrity: rashes, lesions, abrasions, burns, lacerations, surgical wounds, pressure injuries noted Pain or pruritus (itching) present
Hair	Full distribution of hair on the head, axilla, and genitalia	Alopecia (hair loss), hirsutism (excessive hair growth over body), lice and/or nits, or lesions under hair
Nails	Smooth, well-shaped, and firm but flexible	Cracked, chipped, or splitting nail; excessively thick; presence of clubbing; ingrown nails
Skin Integrity	Skin intact with no wounds or pressure injuries. Braden Scale is 23	A wound or pressure injury is present, or there is risk of developing a pressure injury with a Braden scale score of less than 23

Diagnostic and Lab Work

When a chronic wound is not healing as expected, laboratory test results can provide additional clues for the delayed healing. See Table 10.6d for a summary of lab results that offer clues to systemic issues causing delayed wound healing.

Table 10.6d Lab Values Associated with Delayed Wound Healing⁹

9. Grey, J. E., Enoch, S., & Harding, K. G. (2006). Wound assessment. *BMJ (Clinical research ed.)*, 332(7536), 285–288. <https://doi.org/10.1136/bmj.332.7536.285>

Abnormal Lab Value	Rationale
Low hemoglobin	Low hemoglobin indicates less oxygen is transported to the wound site.
Elevated white blood cells (WBC)	Increased WBC indicates infection is occurring.
Low platelets	Platelets have an important role in the creation of granulation tissue.
Low albumin	Low albumin indicates decreased protein levels. Protein is required for effective wound healing.
Elevated blood glucose or hemoglobin A1C	Elevated blood glucose and hemoglobin A1C levels indicate poor management of diabetes mellitus, a disease that negatively impacts wound healing.
Elevated serum BUN and creatinine	BUN and creatinine levels are indicators of kidney function, with elevated levels indicating worsening kidney function. Elevated BUN (blood urea nitrogen) levels impact wound healing because it can indicate increased breakdown of the body's protein stores due to deficient protein in the diet.
Positive wound culture	Positive wound cultures indicate an infection is present and provide additional information including the type and number of bacteria present, as well as identifying antibiotics the bacteria is susceptible to. The nurse reviews this information when administering antibiotics to ensure the prescribed therapy is effective for the type of bacteria present.

Life Span and Cultural Considerations

NEWBORNS AND INFANTS

Newborn skin is thin and sensitive. It tends to be easy to scratch and bruise and is susceptible to rashes and irritation. Common rashes seen in newborns and infants include diaper rash (contact dermatitis), cradle cap (seborrheic dermatitis), newborn acne, and prickly heat.

TODDLERS AND PRESCHOOLERS

Because of high levels of activity and increasing mobility, this age group is more prone to accidents. Issues like lacerations, abrasions, burns, and sunburns can occur frequently. It is important to be highly aware of the potential for accidents and implement safety precautions as needed.

SCHOOL-AGED CHILDREN AND ADOLESCENTS

Skin rashes tend to affect skin within this age group. Impetigo, scabies, and head lice are commonly seen and may keep children home from school. Acne vulgaris typically begins during adolescence and can alter physical appearance, which can be very upsetting to this age group. Another change during adolescence is the appearance of axillary, pubic, and other body hair. Also, as these children spend more time out of doors, sunburns are more common, and care should be given to encourage sunscreen and discourage the use of tanning beds.

ADULTS AND OLDER ADULTS

As skin ages, many changes take place. Because aging increases the loss of subcutaneous fat and collagen breakdown, skin becomes thinner and wrinkles deepen. Decreased sweat gland activity leads to drier skin and pruritus (itching). Wound healing is slowed because of reduced circulation and the inability of proteins and proper nutrients to arrive at injury sites. Hair loses pigmentation and turns gray or white. Nails become thicker and are more difficult to cut. Age or liver spots become darker and more noticeable. The number of skin growths increases and includes skin tags and keratoses.

Diagnoses

There are several NANDA-I nursing diagnoses related to clients experiencing skin alterations or those at risk of developing a skin injury. See Table 10.6e for common NANDA-I nursing diagnoses and their definitions.

Table 10.6e Common NANDA-I Nursing Diagnoses Related to Integumentary Disorders¹⁰

<p>Risk for Adult Pressure Injury: Adult susceptible to localized damage to the skin and/or underlying tissue, as a result of pressure, or pressure in combination with shear, which may compromise health.</p>
<p>Impaired Skin Integrity: Altered epidermis and/or dermis.</p>
<p>Risk for Impaired Skin Integrity: Susceptible to alteration in epidermis and/or dermis, which may compromise health.</p>
<p>Impaired Tissue Integrity: Damage to the mucous membrane, cornea, integumentary system, muscular fascia, muscle, tendon, bone, cartilage, joint capsule, and/or ligament.</p>
<p>Risk for Impaired Tissue Integrity: Susceptible to damage to the mucous membrane, cornea, integumentary system, muscular fascia, muscle, tendon, bone, cartilage, joint capsule, and/or ligament, which may compromise health.</p>

For example, a commonly used NANDA-I nursing diagnosis for clients experiencing alterations in the integumentary system is *Impaired Tissue Integrity*, defined as, “Damage to the mucous membrane, cornea, integumentary system, muscular fascia, muscle, tendon, bone, cartilage, joint capsule, and/or ligament.”

To verify accuracy of this diagnosis for a client, the nurse compares assessment findings with defining characteristics of that diagnosis. Selected defining characteristics for *Impaired Tissue Integrity* include the following¹¹:

- Acute pain
- Bleeding

10. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.

11. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.

- Impaired skin integrity
- Hematoma
- Localized area hot to touch
- Localized swelling or numbness

A sample NANDA-I diagnosis in PES format would be: *Impaired Tissue Integrity related to pressure over bony prominence as evidenced by localized area of swelling that is hot to touch.*

Outcome Identification

An example of a broad goal for a client experiencing alterations in tissue integrity is:

- *The client will experience tissue healing.*

A sample SMART expected outcome for a client with a wound is:

- *The client's wound will decrease in size and have increased granulation tissue within two weeks.*

Planning Interventions

In addition to the interventions outlined under the “[Braden Scale](#)” section to prevent and treat pressure injury, see the following box for a list of interventions to prevent and treat impaired skin integrity. As always, consult a current, evidence-based nurse care planning resource for additional interventions when planning client care.

Selected Interventions to Prevent and Treat Impaired Skin Integrity^{12, 13, 14}

- Routinely assess and document the client's skin condition (Frequency is determined based on the client's status.)
- Use an assessment tool to identify clients at risk for skin breakdown (e.g., Braden Scale). Customize interventions to prevent and treat skin breakdown according to client risk factors and status.
- If a wound is present, evaluate the healing process at every dressing change. Note and document characteristics of the wound, including size, appearance, staging (if applicable), and drainage. Notify the provider of new signs of infection or lack of progress in healing.
- Provide wound care treatments, as prescribed by the provider or wound care specialist, and monitor the client's response toward expected outcomes.
- Cleanse the wound per facility protocol or as ordered.
- Maintain non-touch or aseptic technique when performing wound dressing changes, as indicated. (Read

12. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.

13. Ackley, B., Ladwig, G., & Makic, M. B. (2016). *Nursing diagnosis handbook: An evidence-based guide to planning care* (11th ed.). pp. 884-885. Elsevier.

14. Cox, J. (2019). Wound care 101. *Nursing*, 49(10), 32-39. <https://doi.org/10.1097/01.nurse.0000580632.58318.08>

more details about using aseptic technique and the non-touch method in the “[Aseptic Technique](#)” chapter of the *Open RN Nursing Skills, 2e* textbook.)

- Change wound dressings as needed to keep them clean and dry and prevent bacterial reservoir.
- Monitor for signs of infection in an existing wound (as indicated by redness, warmth, edema, increased pain, reddened appearance of surrounding skin, fever, increased white blood cell count, changes in wound drainage, or sudden change in client’s level of consciousness).
- Apply lotion to dry areas to prevent cracking.
- Apply lubricant to moisten lips and oral mucosa, as needed.
- Keep skin free of excess moisture. Use moisture barrier ointments (protective skin barriers) or incontinence products in skin areas subject to increased moisture and risk of skin breakdown.
- Educate the client and/or family caregivers on caring for the wound and request return demonstrations, as appropriate.
- Administer medications, as prescribed, and monitor for expected effects.
- Consult with a wound specialist, as needed.
- Obtain specimens of wound drainage for wound culture, as indicated, and monitor results.
- Advocate for pressure-relieving devices in clients at risk for pressure injuries, such as elbow protectors, heel protectors, chair cushions, and specialized mattresses and monitor the client’s response.
- Promote adequate nutrition and hydration intake, unless contraindicated.

- Use a minimum of two-person assistance and a draw sheet to pull a client up in bed to minimize shear and friction.
- Reposition the client frequently to prevent skin breakdown and to promote healing. Turn the immobilized client at least every two hours, according to a specific schedule.
- Maintain a client's position at 30 degrees or less, as appropriate, to prevent shear.
- Keep bed linens clean, dry, and wrinkle free.

Implementation

Before implementing interventions, it is important to assess the current status of the skin and risk factors present for skin breakdown and modify interventions based on the client's current status. For example, if a client's rash has resolved, some interventions may no longer be appropriate (such as applying topical creams). However, if a wound is showing signs of worsening or delayed healing, additional interventions may be required. As always, if the client demonstrates new signs of localized or systemic infection, the provider should be notified.

Evaluation

It is important to evaluate for healing when performing wound care. Use the following expected outcomes when evaluating wound healing:

- Resolution of periwound redness in 1 week
- 50% reduction in wound dimensions in 2 weeks
- Reduction in volume of exudate
- 25% reduction in amount of necrotic tissue/eschar in 1 week
- Decreased pain intensity during dressing changes¹⁵

If a client is experiencing delayed wound healing or has a chronic wound, it is helpful to advocate for a referral to a wound care nurse specialist.

▶ Read a [sample nursing care plan](#) for a client with impaired skin integrity.

15. Bryant, R. A., & Nix, D. P. (2010). *Acute and chronic wounds: Current management concepts* (4th ed.). Elsevier.

10.7 Putting It All Together

OPEN RESOURCES FOR NURSING (OPEN RN)

Review the following example of applying the nursing process to a client with a pressure injury.

Client Scenario



Figure 10.24 Simulated Client Image

Ms. Betty Pruitt is a 92-year-old female admitted to a skilled nursing facility after a fall at her daughter's home while transferring the client from her bed to a wheelchair. See Figure 10.24 for an image of Ms. Pruitt.¹ Although no injury was sustained, it became clear to the family that they could no longer provide adequate care at home.

Ms. Pruitt's past medical history includes congestive heart failure,

1. "[1068481.jpg](#)" by unknown is licensed under [CC0](#)

hypertension, hypercholesterolemia, and moderate stage Alzheimer's disease. Her cognitive ability has significantly declined over the last six months. Her speech continues to be mostly clear and at times coherent, but she tends to be quiet and does not express her needs adequately, even with prompting. She no longer has the ability to ambulate but can stand for short periods of time, requiring two people to transfer. She rarely changes body position without encouragement and assistance, spending most of her days in a recliner or bed. Ms. Pruitt is 69 inches tall and currently weighs 122 pounds, having lost 22 pounds over the last three months. BMI is 18. Her family reports her appetite is poor, and she eats only in small amounts at mealtimes with feeding assistance. She does take liquids well and shows no swallowing difficulties at this time. Ms. Pruitt is incontinent of urine and stool most of the time but will use the toilet if offered and given transfer help. A skin assessment revealed a Stage III pressure injury on her coccyx area that is unknown to the family. The wound measures 4 cm long, 4 cm wide, and 3 cm deep, with adipose tissue visible but no undermining or tunneling visible. There is a scant amount of yellowish purulent drainage noted with a slight foul odor, redness, and increased heat around the wound present.

A Braden Scale Risk Assessment was completed and revealed a total score of 12 (High Risk) with the following category scores: Sensory Perception-3, Moisture-2, Activity-2, Mobility-2, Nutrition-2, Friction & Shear-1.

Applying the Nursing Process

Based on this information, the following nursing care plan was implemented for Ms. Pruitt.

Nursing Diagnosis: *Impaired Tissue Integrity related to imbalanced nutritional state and associated with impaired mobility as evidenced by damaged tissue, redness, area hot to touch.*

Overall Goal: *The client will experience wound healing demonstrated by decreased wound size and increased granulation tissue.*

SMART Expected Outcome: *Ms. Pruitt will have a 50% reduction in wound dimensions (from 4 cm in diameter to 2 cm) within two weeks.*

Planned Nursing Interventions With Rationale: See Table 10.7 for a list of planned nursing interventions with rationale.

Table 10.7 Selected Interventions and Rationale for Ms. Pruitt

Interventions	Rationale
1. Assess and document wound characteristics every shift, including size (length x width x depth), stage (I-IV), location, exudate, presence of granulation tissue, and epithelization.	Consistent and accurate documentation of wounds is important in determining the progression of wound healing and effectiveness of treatments.
2. Monitor for signs of infection (color, temperature, edema, moisture, pain, and appearance of surrounding skin).	Frequent monitoring for possible wound infection provides the ability to intervene quickly if changes in the wound are noted.
3. Offer PRN pain medications prior to dressing changes if pain is present.	Dressing changes may be painful for clients. PRN pain medications should be offered in advance of the procedure for effective pain management.
4. Cleanse wound and periwound area (skin around the wound) per facility protocol or as ordered.	Removal of exudate, dirt, and slough promotes wound healing. Decreasing the number of microorganisms around the wound may decrease the chance of wound infection.
5. Apply and change wound dressings, per facility protocol or wound orders.	Dressings that maintain moisture in the wound keep periwound skin dry, absorb drainage, and pad the wound to protect from further injury assist in healing.
6. Turn/reposition the client every two hours and position with pillows as needed.	Frequent repositioning relieves pressure point areas from damage. Avoid positioning the client directly on an injured area if possible.
7. Consider the use of a specialty mattress, bed, or chair pad.	Specialty mattresses, beds, or pads offer added padding and support, while decreasing pressure areas.
8. Use moisture barrier ointments (protective skin barriers).	Moisture barrier ointments can significantly decrease skin breakdown and pressure injury formation.
9. Check incontinence pads frequently (every two to three hours) and change as needed to keep dry.	Frequent changing of soiled pads will prevent exposure to chemicals in urine and stool that erode the skin.
10. Monitor nutritional status and obtain order for dietary consult if needed.	Optimizing nutritional intake, including calories, protein, and vitamins, is essential to promote wound healing.
11. Offer nutritional supplements and water.	Nutritional supplements, such as protein shakes, can provide additional calories and protein without a large volume of intake needed. Water intake is essential for proper tissue hydration.

12. Keep bed linens clean, dry, and wrinkle free.	Soiled, wet, or wrinkled sheets may contribute to skin breakdown.
13. Use a minimum of two-person assistance and a draw sheet to pull the client up in bed.	Carefully transferring clients avoids adverse effects of external mechanical forces (pressure, friction, and shear) from causing skin or tissue damage.

Interventions Implemented:

After the admission assessment was completed, Ms. Pruitt became settled in her new room. The wound was assessed, documented, and cleansed. A specimen for wound culture was obtained and a wound dressing applied per protocol. The health care provider was notified of the wound. Requests were made for a wound culture, referrals to a wound care nurse specialist and a dietician, and a pressure-relieving mattress for the bed. A two-hour turning schedule was implemented, and the CNA was reminded to use two-person assistance with a lift sheet when repositioning the client. A barrier cream was applied to protect the peri-area whenever a new incontinence pad was placed. The following documentation note was entered in the client chart.

Sample Documentation:

7/1/2024 1030: On admission, a Stage III pressure injury was discovered on the client's coccyx area. The wound measured 4 cm long, 4 cm wide, 3 cm deep, with adipose tissue visible. No undermining, tunneling, bone, muscle, or tendons visible. A small amount of yellow purulent drainage noted. Slight foul odor, with redness, and increased heat around the wound present. Wound was cleansed with normal saline and packed with moist gauze and covered with hydrogel dressing. Client tolerated the procedure well and gave no evidence of pain. A pressure-relieving mattress was placed on the client's bed and a two-hour turning schedule was implemented. Client voided x 1 and the pad was changed. Barrier cream was applied to the perineal area. Client encouraged to rest until lunchtime and is resting comfortably at this time. -S. Jones, RN

Evaluation:

After two weeks, the measurements of the wound were compared to those on admission and the wound decreased in size to less than 2 cm. The expected outcome was "met." A new expected outcome was established, "Ms.

Pruitt's wound will resolve within the next 2 weeks." The same planned interventions were continued to be implemented.

10.8 Learning Activities

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Learning Activities

(Answers to “Learning Activities” can be found in the “Answer Key” at the end of the book. Answers to interactive activity elements will be provided within the element as immediate feedback.)

You are a nurse working in a long-term care facility. You have been assigned to care for Mr. Johns, a 74-year-old client recently diagnosed with a urinary tract infection, resulting in frequent incontinence. Mr. Johns suffered a cerebrovascular accident (stroke) six months ago and has difficulties ambulating and attending to his own needs because of weakness on his right side. Mr. Johns is alert and oriented to person, place, and time, but has decreased sensation on his entire right side. He spends most of his time in bed or sitting at his bedside in a wheelchair due to his difficulty with ambulation. He eats about 50% of his meals. While assessing Mr. Johns, you note that he is thin for his height, incontinent of foul-smelling urine, and has a red area of skin on his sacrum.

1. What additional information, including lab work, would you like to gather to further assess Mr. Johns' potential for pressure injury development?
2. What factors make him particularly vulnerable to the

development of pressure injuries?



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<https://wtcs.pressbooks.pub/nursingfundamentals/?p=575#h5p-90>



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=575#h5p-22>



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=575#h5p-23>



Test your knowledge using this [NCLEX Next Generation-style](#)

▶ [bowtie question](#). You may reset and resubmit your answers to this question an unlimited number of times.¹

1. "[Chapter 10 Assignment 1](#)" by Tami Davis for [OpenRN](#) is licensed under [CC BY-NC 4.0](#)

X Glossary

OPEN RESOURCES FOR NURSING (OPEN RN)

Angiogenesis: The process of wound healing when new capillaries begin to develop within the wound 24 hours after injury to bring in more oxygen and nutrients for healing. ([Chapter 10.3](#))

Approximated edges: The well-closed edges of a wound healing by primary intention. ([Chapter 10.3](#))

Arterial insufficiency: A condition caused by lack of adequately oxygenated blood supply to specific tissues. ([Chapter 10.2](#))

Braden Scale: A standardized assessment tool used to assess and document a client's risk factors for developing pressure injuries. ([Chapter 10.5](#))

Deep tissue pressure injuries: Persistent; non-blanchable; deep red, maroon, or purple discoloration of intact or nonintact skin revealing a dark wound bed or blood-filled blister. Pain and temperature change often precede skin color changes. Discoloration may appear differently in darkly pigmented skin. ([Chapter 10.4](#))

Dehiscence: The separation of a surgical incision. ([Chapter 10.2](#))

Dermis: The layer of skin under the epidermis, containing hair follicles, sebaceous glands, blood vessels, endocrine sweat glands, and nerve endings. ([Chapter 10.2](#))

Edema: Swelling. ([Chapter 10.3](#))

Epidermis: The very thin, top layer of the skin that contains openings of the sweat gland ducts and the visible part of hair known as the hair shaft. ([Chapter 10.2](#))

Epithelialization: The development of new epidermis and granulation tissue in a healing wound. ([Chapter 10.3](#))

Erythema: Redness. ([Chapter 10.3](#))

Eschar: Dark brown/black, dry, thick, and leathery dead tissue in wounds. ([Chapter 10.4](#))

Excoriation: Redness and removal of the surface of the topmost layer of skin, often due to maceration or itching. ([Chapter 10.2](#))

Exudate: Fluid that oozes from a wound. ([Chapter 10.3](#))

Friction: The rubbing of skin against a hard object, such as the bed or the arm of a wheelchair. This rubbing causes heat that can remove the top layer of skin and often results in skin damage. ([Chapter 10.4](#))

Granulation tissue: New connective tissue in a healing wound with new, fragile, thin-walled capillaries. ([Chapter 10.3](#))

Hemostasis phase of wound healing: The first stage of wound healing when clotting factors are released to form clots to stop the bleeding. ([Chapter 10.3](#))

Hypodermis: The bottom layer of skin, also referred to as the subcutaneous layer, consisting mainly of adipose tissue or fat, along with some blood vessels and nerve endings. Beneath this layer lies muscles, tendons, ligaments, and bones. ([Chapter 10.2](#))

Impaired skin integrity: Altered epidermis and/or dermis. ([Chapter 10.2](#))

Impaired tissue integrity: Damage to deeper layers of the skin or other integumentary structures. The NANDA-I definition of impaired tissue integrity is, “Damage to the mucous membrane, cornea, integumentary system, muscular fascia, muscle, tendon, bone, cartilage, joint capsule, and/or ligament.” ([Chapter 10.2](#))

Inflammatory phase of wound healing: The second stage of healing when vasodilation occurs to move white blood cells into the wound to start cleaning the wound bed. ([Chapter 10.3](#))

Maceration: A condition that occurs when skin has been exposed to moisture for too long causing it to appear soggy, wrinkled, or whiter than usual. ([Chapter 10.2](#))

Maturation phase of wound healing: The final stage of wound healing when collagen continues to be created to strengthen the wound and prevent it from reopening. ([Chapter 10.3](#))

Necrosis: Tissue death. ([Chapter 10.2](#))

Necrotic: Dead tissue that is black. ([Chapter 10.2](#))

Nonblanchable erythema: Skin redness that does not turn white when pressed. ([Chapter 10.4](#))

Pressure injuries: Localized damage to the skin or underlying soft tissue,

usually over a bony prominence, as a result of intense and prolonged pressure in combination with shear. ([Chapter 10.4](#))

Primary intention: A type of wound that is sutured, stapled, glued, or otherwise closed so the wound heals beneath the closure. ([Chapter 10.3](#))

Proliferative phase of wound healing: The third stage of wound healing that begins a few days after injury and includes four processes: epithelialization, angiogenesis, collagen formation, and contraction. ([Chapter 10.3](#))

Purulent: Drainage that is thick; opaque; tan, yellow, green, or brown in color. New purulent drainage should always be reported to the health care provider. ([Chapter 10.6](#))

Sanguineous: Drainage from a wound that is fresh bleeding. ([Chapter 10.6](#))

Secondary intention: A type of healing that occurs when the edges of a wound cannot be brought together, so the wound fills in from the bottom up by the production of granulation tissue. An example of a wound healing by secondary intention is a pressure ulcer. ([Chapter 10.3](#))

Serosanguineous: Serous drainage with small amounts of blood present. ([Chapter 10.6](#))

Serous: Drainage from a wound that is clear, thin, watery plasma. It's normal during the inflammatory stage of wound healing, and small amounts are considered normal wound drainage. ([Chapter 10.6](#))

Shear: Damage that occurs when tissue layers move over the top of each other, causing blood vessels to stretch and break as they pass through the subcutaneous tissue. ([Chapter 10.4](#))

Slough: Inflammatory exudate in wounds that is usually light yellow, soft, and moist. ([Chapter 10.4](#))

Stage 1 pressure injuries: Intact skin with a localized area of nonblanchable erythema where prolonged pressure has occurred. ([Chapter 10.4](#))

Stage 2 pressure injuries: Partial-thickness loss of skin with exposed dermis. The wound bed is viable and may appear like an intact or ruptured blister. ([Chapter 10.4](#))

Stage 3 pressure injuries: Full-thickness tissue loss in which fat is visible, but cartilage, tendon, ligament, muscle, and bone are not exposed. The depth of tissue damage varies by anatomical location. Undermining and tunneling

may be present. If slough or eschar obscures the wound so that tissue loss cannot be assessed, the pressure injury is referred to as unstageable. ([Chapter 10.4](#))

Stage 4 pressure injuries: Full-thickness tissue loss like Stage 3 pressure injuries but also have exposed cartilage, tendon, ligament, muscle, or bone. ([Chapter 10.4](#))

Tertiary intention: The healing of a wound that has had to remain open or has been reopened, often due to severe infection or swelling. ([Chapter 10.3](#))

Tunneling: Passageways underneath the surface of the skin that extend from a wound and can take twists and turns. ([Chapter 10.4](#))

Undermining: A condition that occurs in wounds when the tissue under the wound edges becomes eroded, resulting in a pocket beneath the skin at the wound's edge. ([Chapter 10.4](#))

Unstageable pressure injuries: Full-thickness skin and tissue loss in which the extent of tissue damage within the ulcer cannot be confirmed because it is obscured by slough or eschar. ([Chapter 10.4](#))

Venous insufficiency: A condition that occurs when the cardiovascular system cannot adequately return blood and fluid from the extremities to the heart. ([Chapter 10.2](#))

PART XI

COMFORT

11.1 Comfort Introduction

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Objectives

- Identify cues related to alteration in comfort across the life span
- Identify standards of care for the client experiencing pain
- Identify interventions to increase client comfort
- Contribute to a plan of care for clients with comfort alterations

Pain is a universal sensation that everyone experiences, and acute pain is a common reason why clients seek medical care. Nurses work with the interdisciplinary team to assess and manage pain in a multidimensional approach to provide comfort and prevent suffering. This chapter will review best practices and standards of care for the assessment and management of pain.

11.2 Comfort Basic Concepts

OPEN RESOURCES FOR NURSING (OPEN RN)

Definitions of Pain

Pain has historically been defined as, “Whatever the client says it is, experienced whenever they say they are experiencing it.”¹ In 2020 the International Association for the Study of Pain (IASP) released a revised definition of pain as, “An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage,” along with these additional notes:

- Pain is always a personal experience that is influenced to varying degrees by biological, psychological, and social factors.
- Individuals learn the concept of pain throughout all stages of their life.
- A person’s report of an experience as pain should be respected.
- Although pain usually serves an adaptive role, it can have adverse effects on function, socialization, and psychological well-being.
- Verbal description is only one of several behaviors that express pain. The inability to communicate does not negate the possibility that a person is experiencing pain.²

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. Most pain resolves after the painful stimulus is removed and the body

1. Pasero, C., & MacCaffery, M. (2010). *Pain assessment and pharmacological management* (1st ed.). Mosby.

2. International Association for the Study of Pain. (2017). *IASP terminology*. <https://www.iasp-pain.org/Education/Content.aspx?ItemNumber=1698>

has healed, but sometimes pain persists despite removal of the stimulus and apparent healing of the body. Additionally, pain can occur in the absence of any detectable stimulus, damage, or disease.³

Physiology of Pain

Let's begin by reviewing the physiological processes of pain. A **nociceptor** is a type of sensory receptor that responds to potentially damaging stimuli by sending nerve signals to the spinal cord and brain in a process called nociception. There are several types and functions of nociceptors:

- Thermal nociceptors are activated by noxious 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 mucus membranes. It is also used in common over-the-counter creams for pain relief because when it is applied to the skin, it blocks the transmission of pain impulses.⁴

Noxious stimuli are detected by nociceptors and transduced into electrical energy. An action potential is created and transmitted along nociceptor fibers. There are two types of nociceptor fibers, A-Delta and C. A-Delta fibers are fast-conducting fibers and associated with the initial sharp, stinging, or

3. LibreTexts. (2024). *Anatomy and physiology (boundless)*. LibreTexts: Medicine. [https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_\(Boundless\)](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_(Boundless))

4. LibreTexts. (2024). *Anatomy and physiology (boundless)*. LibreTexts: Medicine. [https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_\(Boundless\)](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_(Boundless))

pricking pain sensation. C fibers are slower-conducting fibers and are associated with the secondary sensation of diffuse, dull, burning, and aching pain. The pain impulse is transmitted along these nociceptor fibers to the dorsal horn in the spinal cord and then from the spinal cord to the thalamus, where pain messages are relayed to the cerebral cortex. In the cerebral cortex, pain impulses are perceived, and the conscious awareness of pain occurs.^{5,6} See Figure 11.1⁷ for an illustration of how the pain signal is transmitted from the nociceptors to the spinal cord and then to the brain.

5. LibreTexts. (2024). *Anatomy and physiology (boundless)*. LibreTexts: Medicine. [https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_\(Boundless\)](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_(Boundless))
6. NursingTimes. (2008). *Anatomy and physiology of pain*. <https://www.nursingtimes.net/clinical-archive/pain-management/anatomy-and-physiology-of-pain-18-09-2008/#:~:text=The%20transmission%20process%20occurs%20in,higher%20levels%20of%20the%20brain>
7. “Sketch colored final.png” by Bettina Guebeli is licensed under [CC BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/))

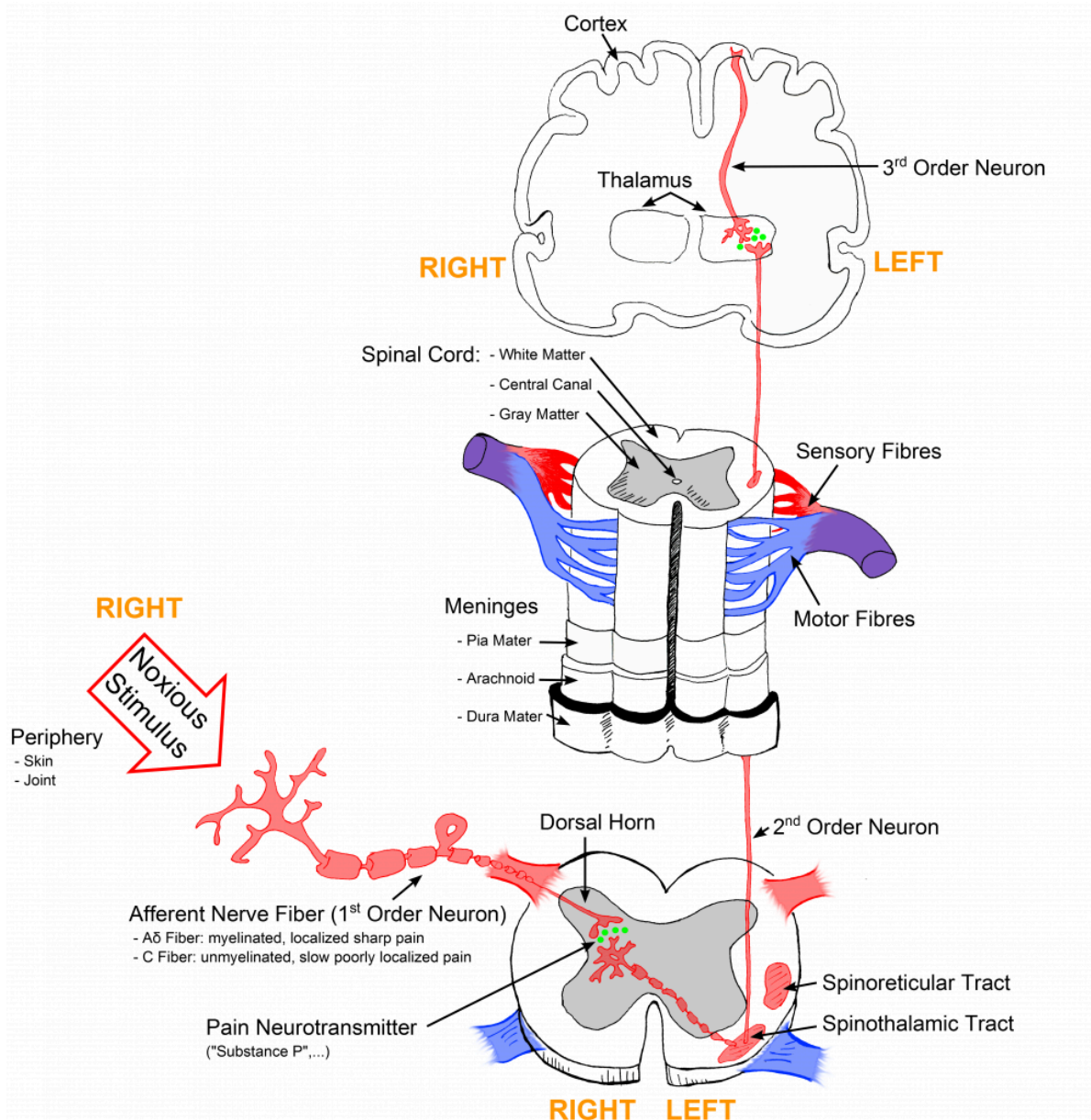


Figure 11.1 Pain Transmission

 View supplementary TED Talk⁸ and Medline Plus⁹ videos on pain:

- [Karen D. Davis: How does your brain respond to pain? | TED Talk](#)
- A one-minute video review of how pain receptors work: [Feeling Pain](#)

Types of Pain

Pain can be divided into visceral, deep somatic, superficial, and neuropathic pain.

- **Visceral** structures are highly sensitive to stretch, ischemia, and inflammation. Visceral pain is diffuse, difficult to locate, and often referred to a distant, usually superficial, structure. It may be accompanied by nausea and vomiting and may be described as sickening, deep, squeezing, and dull.¹⁰
- **Deep somatic pain** is initiated by stimulation of nociceptors in ligaments,

8. Karen D. Davis. (2014, June). *How does your brain respond to pain?*. [Video]. TED-Ed. All rights reserved. https://www.ted.com/talks/karen_d_davis_how_does_your_brain_respond_to_pain?subtitle=en

9. ADAM. (n.d.). *Feeling Pain* [Video]. Medline Plus. All rights reserved. <https://medlineplus.gov/ency/anatomyvideos/000054.htm>

10. LibreTexts. (2024). *Anatomy and physiology (boundless)*. LibreTexts: Medicine. [https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_\(Boundless\)](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_(Boundless))

tendons, bones, blood vessels, fascia, and muscles and is a dull, aching, poorly localized pain. Examples include sprains and broken bones.¹¹

- **Superficial pain** is initiated by the activation of nociceptors in the skin or other superficial tissue and is sharp, well-defined, and clearly located. Examples of injuries that produce superficial somatic pain include minor wounds and minor (first-degree) burns.¹²
- **Neuropathic pain** is defined by the International Association for the Study of Pain (IASP) as pain caused by a lesion or disease of the somatosensory nervous system. It is typically described by clients as “burning” or “like pins and needles.” Neuropathic pain can be caused by several disease processes, such as diabetes mellitus, strokes, and HIV, and is generally undertreated because it typically does not respond to analgesics. Medications such as tricyclic antidepressants and gabapentin are typically used to manage this type of pain.¹³

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

11. LibreTexts. (2024). *Anatomy and physiology (boundless)*. LibreTexts: Medicine. [https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_\(Boundless\)](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_(Boundless))
12. LibreTexts. (2024). *Anatomy and physiology (boundless)*. LibreTexts: Medicine. [https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_\(Boundless\)](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_(Boundless))
13. Murnion, B. P. (2018). Neuropathic pain: Current definition and review of drug treatment. *Australian Prescriber*, 41(3), 60–63. <https://doi.org/10.18773/austprescr.2018.022>

the colon can cause pain to be perceived in the shoulder. See Figure 11.2¹⁴ for an illustration of common sites of referred pain.

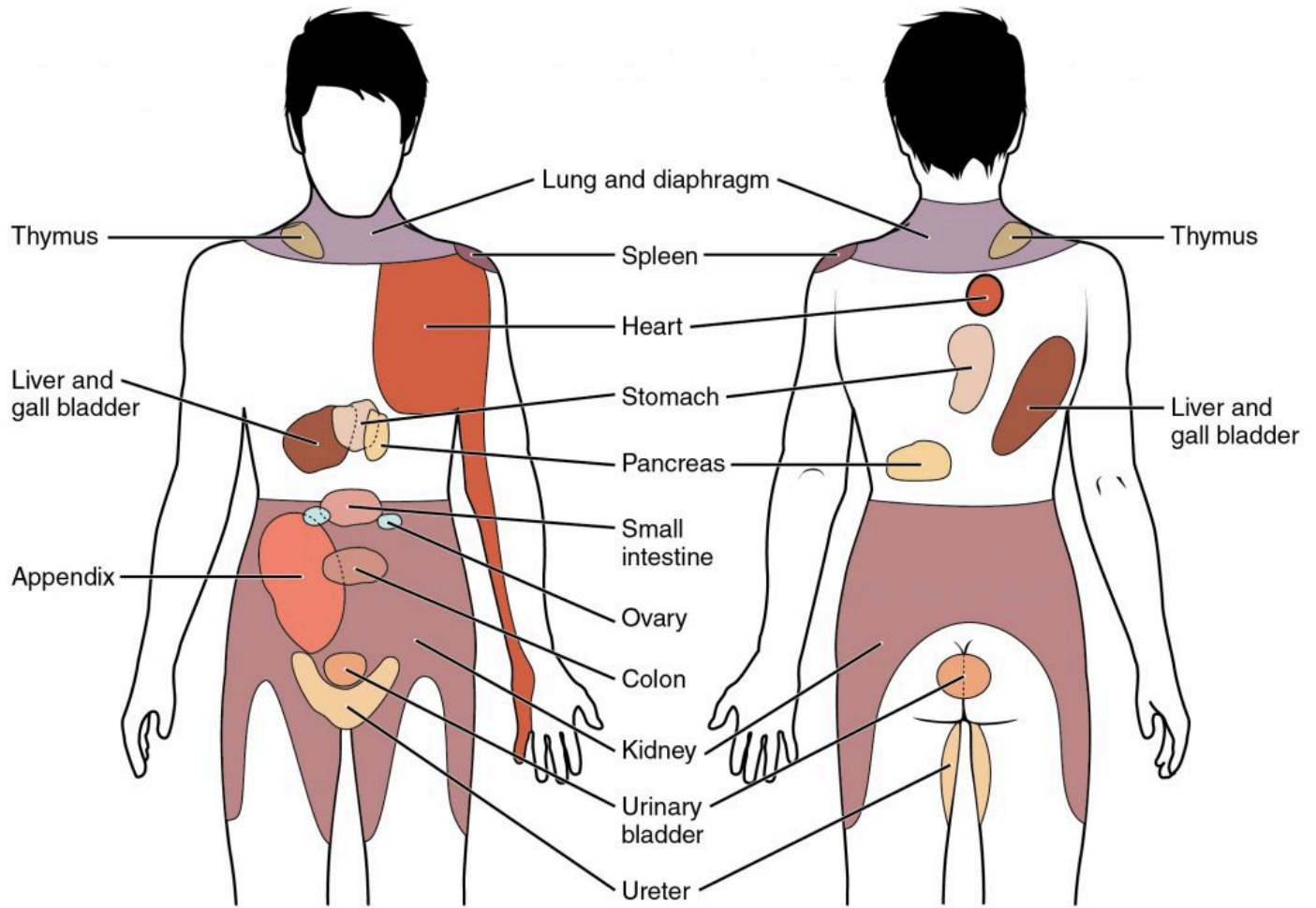


Figure 11.2 Referred Pain

Factors Affecting the Pain Experience

There are many biological, psychological, and social factors that affect the perception of pain, making it a unique, individual experience. See Table 11.2a

14. “1506_Referred_Pain_Chart.jpg” by OpenStax is licensed under [CC BY 3.0](https://creativecommons.org/licenses/by/3.0/). Access for free at <https://cnx.org/contents/C650g-ah@2/Autonomic-Reflexes-and-Homeostasis>

for a list of these factors.¹⁵ Nurses must consider these factors while assessing and providing holistic nursing care for clients experiencing pain.

Table 11.2a Biological, Psychological, and Social Factors Affecting Pain

Biological Factors	Psychological Factors	Social Factors
<ul style="list-style-type: none"> • Nociception • Brain function • Source of pain • Illness • Medical diagnosis • Age • Injury, past or present • Genetic sensitivity • Hormones • Inflammation • Obesity • Cognitive function 	<ul style="list-style-type: none"> • Mood/affect • Fatigue • Stress • Coping • Trauma • Sleep • Fear • Anxiety • Developmental stage • Meaning of pain • Memory • Attitude • Beliefs • Emotional status • Expectations 	<ul style="list-style-type: none"> • Culture • Values • Economic • Environment • Social support • Coping mechanisms • Spirituality • Ethnicity • Education

Acute vs. Chronic Pain

Pain is differentiated between acute pain and chronic pain. **Acute pain** has limited duration and is associated with a specific cause. It usually causes a physiological response resulting in increased pulse, respirations, and blood pressure. Diaphoresis (sweating, especially to an unusual degree) may also occur. Examples of acute pain include postoperative pain; burns; acute

15. Pain Management Best Practices Inter-Agency Task Force. (2019, May 9). *Pain management best practices*. U.S. Department of Health and Human Services. <https://www.hhs.gov/sites/default/files/pmtf-final-report-2019-05-23.pdf>

musculoskeletal conditions like strains, sprains, and fractures; labor and delivery; and traumatic injury.

Chronic pain is ongoing and persistent for longer than six months. It typically does not cause a change in vital signs or diaphoresis. It may be diffuse and not 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. 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. Some people suffer chronic pain even when there is no past injury or apparent body damage.

People who have chronic pain often have physical effects that are stressful on the body. These effects include tense muscles, limited ability to move around, 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.¹⁶ It is estimated that chronic pain affects 50 million U.S. adults, and 19.6 million of those adults experience high-impact chronic pain that interferes with daily life or work activities.¹⁷ See Figure 11.3¹⁸ for an illustration of low back pain, an example of both acute and chronic pain that often affects daily functioning.

16. Cleveland Clinic. (2020). *Acute v. chronic pain*. <https://my.clevelandclinic.org/health/articles/12051-acute-vs-chronic-pain>

17. Pain Management Best Practices Inter-Agency Task Force. (2019). *Pain management best practices*. U.S. Department of Health and Human Services. <https://www.hhs.gov/sites/default/files/pmtf-final-report-2019-05-23.pdf>

18. "[Lower back pain.jpg](#)" by Injurymap is licensed under [CC BY 4.0](#)



Figure 11.3 Back Pain

- ▶ Read additional information about pain using the following:
 - [Overview of Pain – Brain, Spinal Cord, and Nerve Disorders](#)
 - [Pain](#)
 - [Assessing and Managing Acute Pain: A Call to Action](#)
 - [Quick Facts: Chronic Pain](#)

Life Span and Cultural Considerations

The pain experience varies across the life span. Newborns and infants can feel pain but are unable to verbalize it. Repetitive and prolonged pain may be associated with altered pain sensitivity and pain processing later in life.

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-age children and

adolescents may try to be “brave” and rationalize the pain; they are more responsive to explanations about pain.

Older adults are at increased risk for undertreatment of pain. It is estimated that up to 70% of older adults in the community and up to 85% living in long-term care centers have significant pain due to chronic conditions such as osteoarthritis and peripheral neuropathy. Pain is often underassessed in older adults because they are less likely to report it and also because it can present atypically with confusion and agitation.¹⁹

Other special populations who are at increased risk for the undertreatment of pain include the following:

- Clients with a history of addictive disease
- Nonverbal, cognitively impaired, or unconscious clients
- Clients who endure pain without complaining due to cultural or religious beliefs
- Non-English-speaking clients where communicating is a barrier
- Uninsured or underinsured clients where cost of medications is a barrier²⁰

Nurses must be especially vigilant of nonverbal signs of pain in these at-risk groups and implement appropriate assessment tools and interventions. Read an example of a client with untreated pain in the following box.

A Story About Undertreated Pain

A teenage boy from the Amish community was admitted to

19. American Association of Colleges of Nursing. (n.d.). *End-of-Life-Care (ELNEC)*. <https://www.aacnnursing.org/ELNEC>

20. American Association of Colleges of Nursing. (n.d.). *End-of-Life-Care (ELNEC)*. <https://www.aacnnursing.org/ELNEC>

the hospital after he sustained several fractures when his buggy was hit by a motor vehicle. His parents stayed at his bedside throughout his hospital stay. The nurses noticed that although he denied pain, he grimaced and guarded the body parts that were injured. He moaned when repositioned and declined to get out of bed to begin physical therapy when it was prescribed for rehabilitation. However, despite these nonverbal indicators of pain, he continued to deny the existence of pain and refused all pain medication. One day, when his parents left the room briefly to get coffee, the nurse said to the client, “Most people in your situation experience severe pain. I can see that you are hurting by your expressions when you move. Can you help me to understand why you don’t want any pain medication?” A tear began to fall down the boy’s cheek. He explained that his community does not believe in complaining about pain and to be a man, he must learn how to tolerate suffering. The nurse explained, “It is important for you to attend physical therapy so that you can heal and go home. Can we bring you pain pills every day before physical therapy so that you can participate in the exercises, recover quickly, and go home?” The boy agreed to this plan. The nurse documented her findings and made notes in the care plan to administer the prescribed PRN pain medications one hour before physical therapy was scheduled. She also communicated her findings during the nurse handoff report. The boy was able to satisfactorily complete the prescribed physical therapy and was discharged home the following week.

► Use the following to read more information about treating pain:

- Treating pain in [Special Populations](#)
- The National Institute on Aging provides a wide range of information for older adults: [Pain: You Can Get Help](#).
- Health in Aging offers additional information on pain management at [Pain Management | Aging & Health AZ | American Geriatrics Society](#).

Standards of Care

Pain assessment and management standards were published in 2018 by The Joint Commission. The revised standards require hospitals to identify pain assessment and pain management, including safe opioid prescribing, as an organizational priority. Nurses are expected to implement these best practices. See Table 11.2b for a summary of associated requirements that must be incorporated into nursing care.²¹ If these components are not included when providing nursing care, the hospital may be cited by The Joint Commission and potentially lose Medicare funding.

Table 11.2b The Joint Commission's Pain Assessment and Management Requirements²²

21. The Joint Commission. (2017). *R3 report | Requirements, rationale, reference*. https://www.jointcommission.org/-/media/tjc/documents/resources/patient-safety-topics/sentinel-event/r3_report_issue_11_pain_assessment_8_25_17_final.pdf?db=web&hash=938C24A464A5B8B5646C8E297C8936C1
22. The Joint Commission. (2017). *R3 report | Requirements, rationale, reference*. <https://www.jointcommission.org/-/media/tjc/documents/resources/patient-safety-topics/sentinel-event/>

[r3_report_issue_11_pain_assessment_8_25_17_final.pdf?db=web&hash=938C24A464A5B8B5646C8E297C8936C1](#)

Requirement	Rationale
<p>Clients are screened for pain during emergency department visits and at the time of admission.</p>	<p>The misidentification and undertreatment of pain continue to occur in hospitals.</p> <p>When a client presents to the hospital for other medical issues, pain may be overlooked or missed. Screening clients for pain or the risk of pain at the time of admission and while taking vital signs helps to improve pain identification and treatment.</p>
<p>Criteria to screen, assess, and reassess pain are used that are consistent with the client's age, condition, and ability to understand.</p>	<p>An accurate screening and assessment are required for satisfactory pain management, and the hospital is responsible for ensuring that appropriate screening and assessment tools are readily available and used appropriately.</p>

Clients are involved in the pain management treatment planning process by:

- Collaboratively developing realistic expectations and measurable goals for the degree, duration, and reduction of pain
 - Discussing the criteria used to evaluate treatment progress (for example, relief of pain and improved physical and psychosocial function)
 - Receiving education on pain management, treatment options, and safe use of opioid and nonopioid medications when they are prescribed

Client involvement in planning pain management involves information sharing and collaboration between the client and provider to arrive at realistic expectations and clear goals. Numerous client factors may cause undertreatment or overtreatment of pain, such as pain expectations, knowledge of pain and its treatment, and underreporting of pain. Client involvement in the pain management planning process allows the provider to clarify the objectives of the process and guides clients in a manner that increases the likelihood of treatment adherence.

<p>Client’s pain is treated, or they are referred for treatment.</p> <p>Treatment strategies for pain may include nonpharmacologic, pharmacologic, or a combination of approaches.</p>	<p>Referrals may be required for clients who present with complex pain management needs, such as a client with an opioid use disorder, a client who is at high risk for adverse events but requires treatment with opioids, or a client whose pain management needs exceed the expertise of the client’s provider.</p>
<p>Nonpharmacologic pain treatment modalities are promoted.</p>	<p>Nonpharmacologic modalities should be promoted by ensuring that client preferences are discussed and some nonpharmacologic treatment options provided. Nonpharmacologic strategies include, but are not limited to, physical modalities (e.g., acupuncture therapy, chiropractic therapy, osteopathic manipulative treatment, massage therapy, and physical therapy), relaxation therapy, and cognitive behavioral therapy.</p>
<p>Clients identified as being high risk for adverse outcomes related to opioid treatment are monitored.</p>	<p>The most dangerous adverse effect of opioid analgesics is respiratory depression.</p> <p>Equipment must be available to monitor clients deemed highest risk (e.g., clients with sleep apnea, those receiving continuous intravenous opioids, or those on supplemental oxygen).</p>
<p>Clients experiencing opioid substance abuse are referred to opioid treatment programs.</p>	<p>When clinicians encounter clients who are addicted to opioids, the clients should be referred for treatment. The U.S. Substance Abuse and Mental Health Services Administration provides a directory of opioid treatment programs.</p>
<p>The hospital facilitates access to the Prescription Drug Monitoring Program databases.</p>	<p>Prescription Drug Monitoring Programs (PDMP) aggregate prescribing and dispensing data submitted by pharmacies and health care providers. They are an effective tool for reducing prescription drug abuse and diversion. Read more about PDMP in the “Legal/Ethical” chapter of the <i>Open RN Nursing Pharmacology, 2e</i> textbook.</p>

<p>Client's pain is reassessed and responded to through the following:</p> <p>Evaluation and documentation of:</p> <ul style="list-style-type: none">- Response to pain intervention(s)- Progress toward pain management goals, including functional ability (for example, the ability to take a deep breath, turn in bed, walk with improved pain control)- Side effects of treatment	<p>Reassessment should be completed in a timely manner to determine if the intervention is working or if the client is experiencing adverse effects. Only using a numerical pain scale to monitor a client's pain is inadequate.</p> <p>The Joint Commission's technical advisory panel stressed the importance of assessing how pain affects function and the ability to make progress towards treatment goals. For example, immediately after major abdominal surgery, the goal of pain control may be the client's ability to take a breath without excessive pain. Over the next few days, the goal of pain control may be the ability to sit up in bed or walk to the bathroom without limitation due to pain.</p>
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Clients and their family members are educated on discharge plans related to pain management, including the following:

- Pain management plan of care
 - Side effects of pain management treatment
 - Activities of daily living, including the home environment that might exacerbate pain or reduce effectiveness of the pain management plan of care, as well as strategies to address these issues
 - Safe use, storage, and disposal of opioids when prescribed

During the discharge process, clients and families need education on the importance of how to manage the client's pain at home. Unmanaged pain may cause a client to regress in their recovery process or have uncontrolled pain at home leading to a readmission to the hospital. It is necessary to have a discussion with clients and their families regarding their home environment and activities of daily living that may increase the need for pain management. When a client is being discharged with an opioid medication, education on safe use, including when and how much medication to take, should be included in the discharge plan. Opioid disposal education is also critical to both reduce diversion and decrease the risk of accidental exposure to someone other than the person for whom the opioid was prescribed.

▶ Read The Joint Commission's [Pain Assessment and Management Standards for Hospitals](#).

▶ Read [Pain Management Best Practices](#) from the United States Department of Health & Human Services.

Pain Management and the Opioid Crisis

The American Nurses Association published a position statement in 2018 on the ethical responsibility of nurses to properly manage pain.²³ In 2019 the U.S. Department of Health and Human Services published *Pain Management Best Practices*.²⁴ Why is there continued emphasis on optimal pain management? Let's review some trends related to pain management over the past few decades.

Trends Related to Pain Management

Pain assessment and pain management began to undergo significant changes in the 1990s when pain experts recognized that inadequate assessment and treatment of pain had become a public health issue. Recommendations for improving the quality of pain care were followed by initiatives that recognized clients' reported pain as "the 5th vital sign." Hospital administrators and regulators began to focus on pain scores, encouraging and incentivizing providers to aggressively treat pain to lower pain scores. These trends led to liberal prescribing of opioid pain medications for both acute and chronic pain.

Unfortunately, this increase in prescription of opioid pain medication led to a rise in misuse and overdose deaths related to opioid pain medications. Organizations began to urge caution about the use of opioids for pain, including guidelines published in 2016 by the Centers for Disease Control

23. ANA Center for Ethics and Human Rights. (2018). *Position statement: The ethical responsibility to manage pain and the suffering it causes*. American Nurses Association. <https://www.nursingworld.org/~495e9b/globalassets/docs/ana/ethics/theethicalresponsibilitytomanagepainandthesufferingitcauses2018.pdf>
24. Pain Management Best Practices Inter-Agency Task Force. (2019, May 9). *Pain management best practices*. U.S. Department of Health and Human Services. <https://www.hhs.gov/sites/default/files/pmtf-final-report-2019-05-23.pdf>

(CDC) on prescribing opioids for pain.²⁵ The 2016 CDC guideline led to limited prescriptions of opioids and unintended consequences, such as forced tapering of medications for established clients requiring chronic pain control and the transition of some clients desperate for pain control to using illicit drugs, such as heroin.

In 2022, the CDC released new guidelines for prescribing opioids for pain. The CDC recommends that people experiencing pain receive appropriate pain treatment, with careful consideration of the benefits and risks of all treatment options in the context of the client's circumstances. The guidelines are intended to improve communication with clients about the benefits and risks of pain treatments, including opioid therapy; improve the effectiveness and safety of pain treatment; mitigate pain; improve function and quality of life for clients with pain; and reduce risks associated with opioid pain therapy, including opioid use disorder, overdose, and death.²⁶

In this manner, pain management and the opioid crisis have influenced each other and continue to evolve. It is imperative for nurses to ensure that clients with painful conditions can work with their health care providers to develop pain treatment plans that balance pain control, optimize function, and enhance quality of life while also minimizing risks for opioid misuse and harm.²⁷

25. Cleveland Clinic. (2020). *Acute v. chronic pain*. <https://my.clevelandclinic.org/health/articles/12051-acute-vs-chronic-pain>
26. Dowell, D., Ragan, K. R., Jones, C. M., Baldwin, G. T., & Chou, R. (2022). *CDC clinical practice guideline for prescribing opioids for pain — United States, 2022*. MMWR Recommendation Report. <http://doi.org/10.15585/mmwr.rr7103a1>
27. Pain Management Best Practices Inter-Agency Task Force. (2019). *Pain management best practices*. U.S. Department of Health and Human Services. <https://www.hhs.gov/sites/default/files/pmtf-final-report-2019-05-23.pdf>

Associated Definitions

When discussing pain management and the opioid crisis in the United States, it is important to understand the following terms:

- **Opioid intoxication** refers to significant behavioral or psychological changes (e.g., apathy, dysphoria, psychomotor agitation or retardation, or impaired judgment) that occur during or shortly after opioid use. Symptoms of opioid intoxication include drowsiness or coma, slurred speech, or impairment in attention or memory.²⁸
- **Overdose** is the biological response of the human body when too much of a substance is ingested.
- **Tolerance** refers to a diminished effect with continued use of the same amount of an opioid, or a need for increased amounts of opioids to achieve the desired effect or intoxication.²⁹
- **Misuse** refers to taking prescription pain medications in a manner or dose other than prescribed; taking someone else's prescription, even if for a medical complaint such as pain; or taking a medication to feel euphoria (i.e., to get high).³⁰
- **Substance use disorder** is a neurobiological illness caused by repeated misuse of substances (including opioids, which is specifically referred to as opioid use disorder). When taken in excess, these substances have a common effect of directly activating the brain reward system and producing such an intense activation of the reward system that normal

28. American Psychiatric Association. (2022). *Desk reference to the diagnostic criteria from DSM-5-TR*.

29. American Psychiatric Association. (2022). *Desk reference to the diagnostic criteria from DSM-5-TR*.

30. Pain Management Best Practices Inter-Agency Task Force. (2019). *Pain management best practices*. U.S. Department of Health and Human Services. <https://www.hhs.gov/sites/default/files/pmtf-final-report-2019-05-23.pdf>

life activities may be neglected. A person diagnosed with opioid use disorder has at least two of the symptoms listed below in a given year³¹ :

- Opioids are taken in larger amounts or over a longer period of time than intended.
- There is a persistent desire or unsuccessful efforts to cut down or control opioid use.
- A great deal of time is spent in activities necessary to obtain the opioid, use the opioid, or recover from its effects.
- The person experiences craving, a strong desire or urge to use opioids.
- Recurrent opioid use results in the person's failure to fulfill major role obligations at work, school, or home.
- Opioid use continues despite the person having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of opioids.
- Important social, occupational, or recreational activities are given up or reduced because of opioid use.
- Opioids are recurrently used in situations in which it is physically hazardous.
- Opioids are continued to be used despite the person having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance.
- The person experiences symptoms of tolerance to opioids.
- The person experiences **withdrawal** symptoms causing significant distress after stopping or reducing opioid use, with symptoms such as dysphoric mood, nausea, vomiting, muscle aches, rhinorrhea or lacrimation, pupillary dilation, piloerection, sweating, diarrhea, yawning, fever, or insomnia.
- **Physical dependence** refers to withdrawal symptoms that occur when an opioid is suddenly reduced or stopped because of physiological

31. American Psychiatric Association. (2022). *Desk reference to the diagnostic criteria from DSM-5-TR*.

adaptations that occur with chronic exposure to the medication.³² For example, if a client who receives hydromorphone daily suddenly has their prescription stopped, they will likely experience symptoms of withdrawal, such as sweating, goose bumps, vomiting, anxiety, insomnia, and muscle pain.

- **Addiction** is a term used in many countries to describe severe problems related to compulsive and habitual use of substances. However, it is no longer a diagnosis by the American Psychiatric Association because of its potentially negative connotation.³³

Recognizing and Treating Opioid Overdose

Five basic steps are recommended for nurses, first responders, health professionals, and other bystanders to rapidly recognize and treat opioid overdose to prevent death.³⁴

1. Recognize Signs of Opioid Overdose:

- Signs of opioid overdose include unconsciousness or the inability to awaken; pinpoint pupils; slow, shallow breathing; breathing difficulty manifested by choking sounds or a gurgling/snoring noise from a

32. Pain Management Best Practices Inter-Agency Task Force. (2019). *Pain management best practices*. U.S. Department of Health and Human Services. <https://www.hhs.gov/sites/default/files/pmtf-final-report-2019-05-23.pdf>

33. American Psychiatric Association. (2022). *Desk reference to the diagnostic criteria from DSM-5-TR*.

34. Substance Abuse and Mental Health Services Administration. (2018). *SAMHSA opioid overdose prevention toolkit: Five essential steps for first responders* [Manual]. U.S. Department of Health & Human Services. <https://store.samhsa.gov/sites/default/files/d7/priv/five-essential-steps-for-first-responders.pdf>

person who cannot be awakened; fingernails or lips turning blue or purple; or respiratory arrest

- If an opioid overdose is suspected, try to stimulate the person by calling their name or vigorously grinding one's knuckles into their sternum.

2. **Obtain Emergency Assistance:** If the person does not respond, call 911 or obtain emergency assistance.

3. **Provide Rescue Breathing, Chest Compressions, and Oxygen As Needed:**

- Provide rescue breathing if the person is not breathing on their own. A barrier device is recommended to reduce the risk of disease transmission. Rescue breathing for adults involves the following steps:
 - Be sure the person's airway is clear.
 - Place one hand on the person's chin, tilt the head back, and pinch the nose closed.
 - Place your mouth over the person's mouth to make a seal and give two slow breaths.
 - Watch for the person's chest (but not the stomach) to rise.
 - Follow up with one breath every five seconds.
- If the individual becomes pulseless, provide cardiopulmonary resuscitation (CPR).
- Administer oxygen as needed.

4. **Administer the First Dose of Naloxone:**

- Naloxone should be administered to anyone suspected of an opioid overdose.
- Research has shown that women, older adults, and those without obvious signs of opioid use disorder are undertreated with naloxone and, as a result, have a higher death rate. Therefore, naloxone should be considered for women and the elderly who are found unresponsive.

- Naloxone can be used in life-threatening opioid overdose circumstances in pregnant women.
- Naloxone can be given intranasally, intramuscularly, subcutaneously, or intravenously. The nasal spray is a prefilled device that requires no assembly and delivers a single dose into one nostril. An auto-injector is injected into the outer thigh to deliver naloxone intramuscularly or subcutaneously.
- All naloxone products are effective in reversing opioid overdose, including fentanyl-involved opioid overdoses, although overdoses involving potent or large quantities of opioids may require additional doses of naloxone.
- Withdrawal triggered by naloxone can feel unpleasant; some people may awaken confused, agitated, or aggressive. Provide safety, reassurance, and explain what is happening.

5. Administer a Second Dose of Naloxone If the Person Does Not Respond:

- If the person overdosing does not respond within 2 to 3 minutes after administering a dose of naloxone, administer a second dose of naloxone.
- People who have taken long-acting or potent opioids (like fentanyl) may require additional intravenous bolus doses or an infusion of naloxone.
- The duration of effect of naloxone depends on dose, route of administration, and overdose symptoms. It is shorter than the effects of some opioids, so a second dose may be required.

6. Monitor the Person's Response:

- Most people respond to naloxone by returning to spontaneous breathing within two to three minutes. Continue resuscitation while waiting for the naloxone to take effect.
- The goal of naloxone therapy is to restore adequate spontaneous breathing but not necessarily achieve complete arousal.
- The individual should be monitored for recurrence of signs and

symptoms of opioid toxicity for at least four hours from the last dose of naloxone. People who have overdosed on long-acting opioids like fentanyl patches require prolonged monitoring.

- Because naloxone has a relatively short duration of effect, overdose symptoms may return. Therefore, it is essential to get the person to an emergency department or other source of medical care as quickly as possible, even if the person revives after the initial dose of naloxone and seems to feel better.

Substance Use Disorder Among Nurses and Nursing Students

It is important to understand that substance use disorder is a neurobiological illness that can happen to anyone, including nurses and nursing students.

The American Nursing Association released the following statements in 2016³⁵ :

- Health care facilities should provide education to nurses and other employees regarding alcohol and other drug use and establish policies, procedures, and practices to promote safe, supportive, drug-free workplaces.
- Health care facilities and schools of nursing should adopt alternative-to-discipline approaches to treating nurses and nursing students with substance use disorders, with stated goals of retention, rehabilitation, and reentry into safe, professional practice.
- Nurses and nursing students should be aware of the risks associated with substance use, impaired practice, and drug diversion and have the responsibility and means to report suspected or actual concerns.

35. American Nurses Association. (2016). *Substance use among nurses and nursing students*. <https://www.nursingworld.org/practice-policy/nursing-excellence/official-position-statements/id/substance-use-among-nurses-and-nursing-students>

Read the American Nurses Association (ANA) statement on [Substance Use Among Nurses and Nursing Students](#).

Read the NCSBN brochure on [Substance Use Disorder in Nursing](#). Many states offer assistance to nurses with substance use disorders to maintain their nursing license and employment status. See Wisconsin's [Professional Assistance Procedure \(PAP\)](#) or New York's [Statewide Peer Assistance for Nurses](#) program.

Read more details about substance abuse disorder in the "[Legal/Ethical](#)" chapter in *Open RN Nursing Pharmacology, 2e*.

11.3 Pain Assessment Methods

OPEN RESOURCES FOR NURSING (OPEN RN)

Asking a client to rate the severity of their pain on a scale from 0 to 10, with “0” being no pain and “10” being the worst pain imaginable is a common question used to screen clients for pain. However, according to The Joint Commission requirements described earlier, this question can be used to initially screen a client for pain, but a thorough pain assessment is required. Additionally, the client’s comfort-function goal must be assessed and documented. This individualized comfort-function goal provides the basis for the client’s pain treatment plan and is used to evaluate the effectiveness of interventions and make changes as needed.

PQRSTU, OLDCARTES, and COLDSPA

The “PQRSTU,” “OLDCARTES,” or “COLDSPA” mnemonics are helpful in remembering a standardized set of questions used to gather additional data about a client’s pain. For example, PQRSTU stands for Provocative/Palliative; Quality/Quantity, Region/Radiation, Severity, Timing/Treatment, and Understanding. See Figure 11.4¹ for an illustration of the “PQRSTU” assessment framework.

1. Lapum, J., St-Amant, O., Hughes, M., Petrie, P., Morrell, S., & Mistry, S. (2019). *The complete subjective health assessment*. Open Library.

<https://ecampusontario.pressbooks.pub/healthassessment/>



Figure 11.4 PQRSTU Assessment

While interviewing a client about pain, use open-ended questions to allow the client to elaborate on information that further improves your understanding of their concerns. If their answers do not seem to align, validate data with follow-up questions using the PQRSTU framework to clarify information. For example, if a client states that “the pain is tolerable” but also rates the pain as a “7” on a 0-10 pain scale, these answers do not align, so the data must be validated with follow-up questions using the PQRSTU framework. Upon further questioning the client explains they rate the pain as a “7” in their knee when participating in physical therapy exercises, but currently feels the pain is tolerable while resting in bed. This additional information assists the nurse to customize interventions for effective pain management with reduced potential for overmedication with associated side effects. Sample questions when using the PQRSTU assessment are included in Table 11.3a.

Table 11.3a Sample PQRSTU Focused Questions for Pain

PQRSTU	Questions Related to Pain
Provocation/Palliation	What makes your pain worse? What makes your pain feel better?
Quality	What does the pain feel like? Note: You can provide suggestions for pain characteristics such as “aching,” “stabbing,” or “burning.”
Region	Where exactly do you feel the pain? Does it move around or radiate elsewhere? Note: Instruct the client to point to the pain location.
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’ve 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?

An alternative mnemonic to use when assessing pain is “OLDCARTES.”

- **O**nset: When did the pain start? How long does it last?
- **L**ocation: Where is the pain?
- **D**uration: How long has the pain been going on? How long does an episode last?
- **C**haracteristics: What does the pain feel like? Can the pain be described in terms such as stabbing, gnawing, sharp, dull, aching, piercing, or crushing?
- **A**ggravating factors: What brings on the pain? What makes the pain worse? Are there triggers such as movement, body position, activity, eating, or the environment?

- **R**adiating: Does the pain travel to another area or the body, or does it stay in one place?
- **T**reatment: What has been done to make the pain better and has it been helpful? Examples include medication, position change, rest, and application of hot or cold.
- **E**ffect: What is the effect of the pain on participating in your daily life activities?
- **S**everity: Rate your pain from 0 to 10.

A third mnemonic used is “COLDSPA.”

- **C**: Character
- **O**: Onset
- **L**: Location
- **D**: Duration
- **S**: Severity
- **P**: Pattern
- **A**: Associated Factors

No matter which mnemonic is used to guide the assessment questions, the goal is to obtain comprehensive assessment data that allows the nurse to create a customized nursing care plan that effectively addresses the client’s need for comfort.

Pain Scales

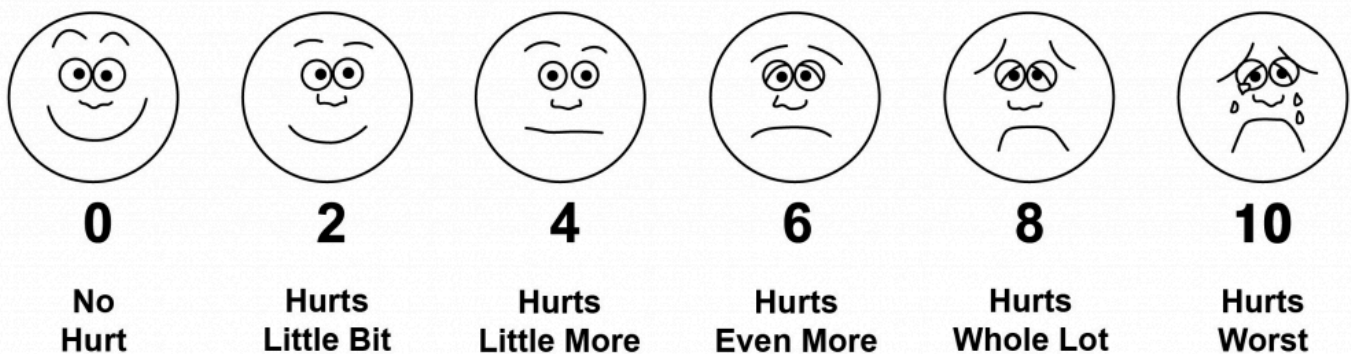
In addition to using the PQRSTU or OLDCARTES methods of investigating a client’s chief complaint, there are several standardized pain rating scales used in nursing practice.

FACES SCALE

The FACES scale is a visual tool for assessing pain with children and others who cannot quantify the severity of their pain on a scale of 0 to 10. See Figure

11.5² for the FACES Pain Rating Scale. To use this scale, use the following evidence-based instructions. Explain to the client 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 person to choose the face that best represents the pain they are feeling.³ Note that the client reports which face best represents how they are feeling and the nurse is not selecting a face based on how the client appears to feel.

Wong-Baker FACES® Pain Rating Scale



©1983 Wong-Baker FACES Foundation. www.WongBakerFACES.org
 Used with permission. Originally published in *Whaley & Wong's Nursing Care of Infants and Children*. ©Elsevier Inc.

Figure 11.5 The Wong-Baker FACES Pain Rating Scale. Used with permission from <http://www.WongBakerFACES.org>.

FLACC SCALE

The FLACC scale (i.e., the Face, Legs, Activity, Cry, Consolability scale) is a measurement used to assess pain for children between the ages of 2 months

2. Wong-Baker FACES Foundation. (2016). Wong-Baker FACES pain rating scale. <https://wongbakerfaces.org/>. Used with permission.
3. Wong-Baker FACES Foundation. (2016). Wong-Baker FACES pain rating scale. <https://wongbakerfaces.org/>. Used with permission.

and 7 years or individuals who are unable to verbally communicate their pain. The scale has five criteria, which are each assigned a score of 0, 1, or 2. The scale is scored in a range of 0–10 with “0” representing no pain.⁴ See Table 11.3b for the FLACC scale.

Table 11.3b The FLACC Scale⁵

Criteria	Score 0	Score 1	Score 2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, or uninterested	Frequent to constant quivering chin; clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, or tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, and moves easily	Squirming, shifting, back and forth, or tense	Arched, rigid, or jerking
Cry	No cry (awake or asleep)	Moans or whimpers or occasional complaint	Crying steadily, screams or sobs, or frequent complaints
Consolability	Content and relaxed	Reassured by occasional touching, hugging, or being talked to; distractible	Difficult to console or comfort

COMFORT BEHAVIORAL SCALE

The COMFORT Behavioral Scale is a behavioral-observation tool validated for use in children of all ages who are receiving mechanical ventilation. Eight

4. Merkel, S. I., Voepel-Lewis, T., Shayevitz, J. R., & Malviya, S. (1997). The FLACC: A behavioral scale for scoring postoperative pain in young children. *Pediatric Nursing, 23*(3). <https://pubmed.ncbi.nlm.nih.gov/9220806/>
5. Merkel, S. I., Voepel-Lewis, T., Shayevitz, J. R., & Malviya, S. (1997). The FLACC: A behavioral scale for scoring postoperative pain in young children. *Pediatric Nursing, 23*(3). <https://pubmed.ncbi.nlm.nih.gov/9220806/>

physiological and behavioral indicators are scored on a scale of 1 to 5 to assess pain and sedation.⁶

▶ View the [COMFORT Behavioral Scale](#).

PAIN ASSESSMENT IN ADVANCED DEMENTIA (PAINAD) SCALE

The Pain Assessment in Advanced Dementia (PAINAD) Scale is a simple, valid, and reliable instrument for assessing pain in noncommunicative clients with advanced dementia. See Table 11.3c for the items included on the scale. Each item is scored from 0-2, When totaled, the score can range from 0 (no pain) to 10 (severe pain).

Table 11.3c The PAINAD Scale⁷

6. Freund, D., & Bolick, B. (2019). CE: Assessing a Child's Pain. *American Journal of Nursing*, 119(5), 34. https://journals.lww.com/ajnonline/Fulltext/2019/05000/CE_Assessing_a_Child_s_Pain.25.aspx

7. Warden, V., Hurley, A., & Volicer, L. (2003). Development and psychometric evaluation of the pain assessment in advanced dementia (PAINAD) scale. *Journal of the American Medical Directors Association*, 4(1), 9-15. <https://doi.org/10.1097/01.JAM.0000043422.31640.F7>

Item	0	1	2
Breathing independent of vocalization	Normal	Occasional labored breathing. Short period of hyperventilation.	Noisy labored breathing. Long period of hyperventilation. Cheyne-Stokes respirations.
Negative vocalization	None	Occasional moan or groan. Low-level speech with a negative or disapproving quality.	Repeated troubled calling out. Loud moaning or groaning. Crying.
Facial Expression	Smiling or inexpressive	Sad. Frightened. Frown.	Facial grimacing.
Body language	Relaxed	Tense. Distressed pacing. Fidgeting.	Rigid. Fists clenched. Knees pulled up. Pulling or pushing away. Striking out.
Consolability	No need to console	Distracted or reassured by voice or touch.	Unable to console, distract, or reassure.

► Download the full [PAINAD scale](#) from The Hartford Institute for Geriatric Nursing.⁸

Comfort-Function Goals

Comfort-function goals encourage the client to establish their level of comfort needed to achieve functional goals based on their current health status. For example, one client may be comfortable ambulating after surgery and their pain level is 3 on a 0-to-10 pain intensity rating scale, whereas another client

8. The Hartford Institute for Geriatric Nursing, New York University, Rory Meyers School of Nursing. (n.d.). *Assessment tools for best practices of care for older adults*. <https://hign.org/consultgeri-resources/try-this-series>

desires a pain level of 0 on a 0-to-10 scale in order to feel comfortable ambulating. To properly establish a client's comfort-function goal, nurses must first describe the essential activities of recovery and explain the link between pain control and positive outcomes.⁹

If a client's pain score exceeds their comfort-function goal, nurses must implement an intervention and follow up within 1 hour to ensure that the intervention was successful. Using the previous example, if a client had established a comfort-function goal of 3 to ambulate and the current pain rating was 6, the nurse would provide appropriate interventions, such as medication, application of cold packs, or relaxation measures. The nurse would then perform a follow-up assessment within an hour to evaluate the effectiveness of these interventions. Documentation of the comfort-function goal, pain level, interventions, and follow-up are key to effective, individualized pain management.¹⁰

9. Boswell, C., & Hall, M. (2017). Engaging the patient through comfort-function levels. *Nursing 2017*, 47 (10), 68-69. https://www.nursingcenter.com/journalarticle?Article_ID=4345712&Journal_ID=54016&Issue_ID=4345459
10. Boswell, C., & Hall, M. (2017). Engaging the patient through comfort-function levels. *Nursing 2017*, 47 (10), 68-69. https://www.nursingcenter.com/journalarticle?Article_ID=4345712&Journal_ID=54016&Issue_ID=4345459

11.4 Pain Management

OPEN RESOURCES FOR NURSING (OPEN RN)

Pain management requires collaboration with the interdisciplinary team, including nurses, health care providers, pharmacists, and sometimes pain specialists. There are many different types of pain medications (called **analgesics**) that can be administered by various routes. Analgesics are classified as nonopioids, opioids, or adjuvants. An **adjuvant** is a medication that has been found in clinical practice to have either an independent analgesic effect or additive analgesic properties when administered with opioids. Examples of adjuvant medications include antidepressants (e.g., amitriptyline) and anti-seizure medications (e.g., gabapentin).

A general rule of thumb when administering analgesics is to use the lowest dose of medication, with fewest potential side effects and the least invasive route of administration, to effectively treat the level of pain as reported by the client. The WHO ladder was originally developed by the World Health Organization for selecting analgesics for clients with cancer pain, but it can be broadened to illustrate this rule of thumb for managing pain appropriately for all clients. See Figure 11.6¹ for an image of the WHO ladder.

For example, if a client reports a pain level of “2,” then a nurse typically starts at the lowest rung of the WHO ladder and administers a prescribed nonopioid via the oral route. If the nonopioid is not effective, then a prescribed adjuvant medication may be administered, or the nurse may decide to step up a rung on the ladder and administer a prescribed oral opioid for mild to moderate pain. On the other hand, if a client reports severe

1. World Health Organization. (1996). *Cancer pain relief: with a guide to opioid availability* (2nd ed.). <http://apps.who.int/iris/bitstream/handle/10665/37896/9241544821.pdf;jsessionid=08444506DC35A33288AD7C0DE6D34667?sequence=1>

pain, the nurse may start at the top rung of the ladder and administer a prescribed opioid for moderate to severe pain via the intravenous route for rapid relief.

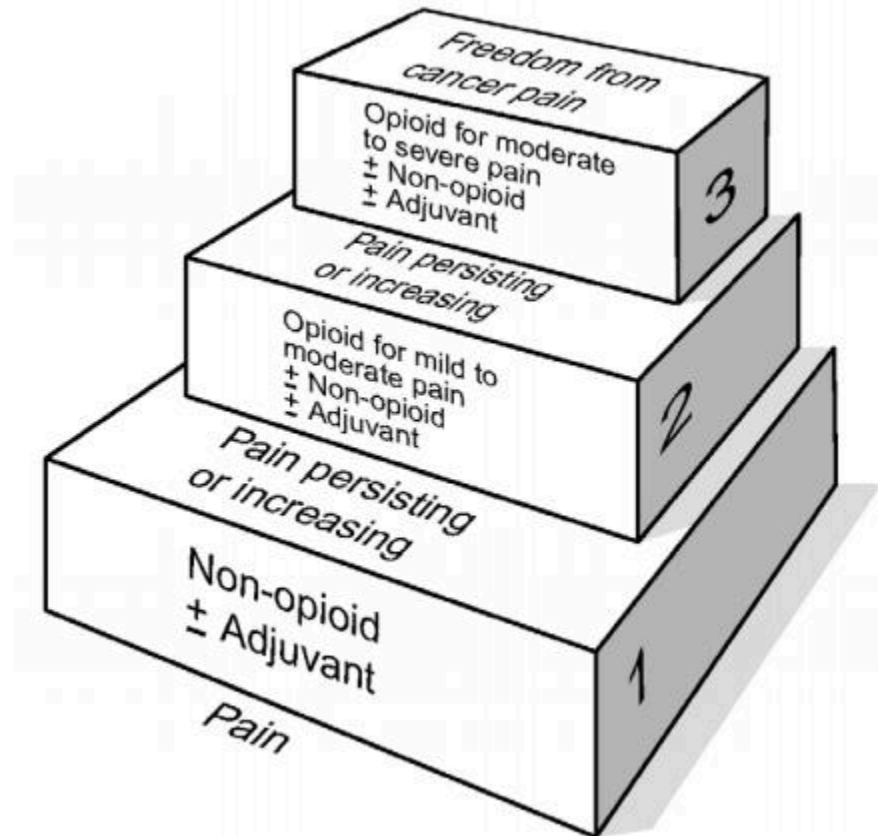


Figure 11.6 The WHO Pain Ladder

Nonopioid Analgesics

Nonopioid analgesics include acetaminophen and NSAIDs.

Acetaminophen

Acetaminophen (Tylenol) is used to treat mild pain and fever but does not have anti-inflammatory properties. Acetaminophen is safe for all ages and can be administered using various routes, such as orally, rectally, and intravenously. Many over-the-counter (OTC) medications contain

acetaminophen, along with other medications. See Figure 11.7² for an image of acetaminophen (Tylenol) and acetaminophen and diphenhydramine (Tylenol PM).

A potential severe side effect of acetaminophen is hepatotoxicity (severe liver damage). Severe liver damage may occur if an adult client takes more than 4,000 mg of acetaminophen in 24 hours (or 3,200 mg for older adults or 2,000 mg for chronic alcoholics) or consumes three or more alcoholic drinks every day while using acetaminophen.

Because some medications are combined with acetaminophen or are prescribed “as needed,” the nurse must calculate the cumulative dose of acetaminophen over the previous 24-hour period before administering an additional dose. For example, Percocet 5/325 contains a combination of oxycodone 5 mg and acetaminophen 325 mg and may be prescribed as “1-2 tablets every 4-6 hours as needed for pain.” If two tablets are truly administered every four hours over a 24-hour period, this would add up to 3,900 mg of acetaminophen, exceeding the recommended guidelines for a geriatric client, with the potential for causing liver damage.

2. [“Extra Strength Tylenol and Tylenol PM.jpg”](#) by [Ragesoss](#) is licensed under [CC BY-SA 4.0](#)



Figure 11.7 Acetaminophen (Tylenol) and Acetaminophen with Benadryl (Tylenol PM)


NSAIDs


Nonsteroidal anti-inflammatory drugs (NSAIDs) provide mild to moderate pain relief and also reduce fever and inflammation by inhibiting the production of prostaglandins. They can also be used as an adjuvant with opioids for severe pain. Examples of NSAIDs include ibuprofen, naproxen, and ketorolac. All NSAIDs, except aspirin, increase the risk of heart attack, heart failure, and stroke, with the risk being higher if the client takes more than is directed or takes it for longer than directed. Common side effects include dyspepsia, nausea, and vomiting, so it is helpful to administer this medication with food. Older adults and those taking NSAIDs concurrently with other drugs, such as warfarin or corticosteroids, are at elevated risk for gastrointestinal bleeding. Renal failure can also occur with NSAIDs.

- Ibuprofen is an over-the-counter medication that is safe for infants six months or older. It is typically prescribed every six to eight hours.
- Naproxen is an over-the-counter medication that is longer acting than

ibuprofen and is typically prescribed every 8 to 12 hours with a full glass of water.

- Ketorolac is a prescribed medication commonly used to treat “breakthrough” pain that occurs during the treatment of severe acute pain already being treated with opioids. It is indicated for the short-term management (up to five days in adults) of moderate to severe acute pain that requires analgesia at the opioid level. Ketorolac is safe for adults, but the dosage should be reduced for clients ages 65 and over and renal function must be closely monitored.

 Read about nonopioid medications in the [“Analgesic and Musculoskeletal”](#) chapter in *Open RN Nursing Pharmacology, 2e*.

 View a supplementary video on [“How Do Pain Relievers Work?”](#)

Opioid Analgesics

Opioids are used to treat moderate to severe pain and work by blocking the release of neurotransmitters involved in the processing of pain. Different opioids have different levels of analgesia, with codeine having the lowest strength and hydromorphone and fentanyl having the highest strength. Morphine is commonly used to treat severe cancer pain and end-of-life pain because there is no ceiling effect, meaning the higher the dose, the higher the level of analgesia, but also the higher level of sedation and respiratory depression. See Table 11.4a for a summary of common opioids. As always, check a drug reference for current dosage ranges before administering medications.

Table 11.4a Common Opioid Analgesics

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 5mg/500 mg
Tramadol	Ultram	PO	Immediate Release: 50 mg Extended Release: 100 mg, 200 mg, 300 mg
Oxycodone (immediate release and extended release) OR Oxycodone with acetaminophen	Oxycodone IR & OxyContin (ER) Percocet & Roxicet	PO PO	5 mg – 10 mg 5 mg/325 mg
Fentanyl	Duragesic, Sublimaze	Transdermal IM IV	12 mcg – 100 mcg/hr 0.5 – 1 mcg/kg 0.5 – 1 mcg/kg
Hydromorphone	Dilaudid	PO Rectal SubQ, IM, & IV	4 – 8 mg 3 mg 1.5 mg (may be increased)
Morphine	Duramorph, MS Contin, Oramorph SR, & Roxanol	PO & Rectal SubQ, IM, & IV	30 mg (may be increased) 4 – 10 mg (may be increased)

Tramadol is available in immediate release and extended-release forms.

Immediate release is prescribed for moderate to moderately severe pain when other pain medications cannot be tolerated or are not effective. Immediate-release tramadol is not intended for use as an “as needed” medication but rather for pain episodes lasting less than a week. The extended-release forms are used to treat chronic ongoing pain.³

Morphine is administered via various routes of administration, including orally, rectally, subcutaneously, intramuscularly, intravenously, and transdermally. See Figure 11.8⁴ for an image of a vial of morphine for injection or intravenous use.



Figure 11.8 Morphine

Some types of opioids can be administered through the skin, such as the fentanyl transdermal patch. See Figure 11.9⁵ for an image of a fentanyl transdermal patch.

3. Dhesi , M., Maldonado, K.A., Patel, P., et al. (2024) *Tramadol*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK537060/>

4. “[Morphine_vial.JPG](#)” by Vaprotan is licensed under [CC BY-SA 3.0](#)

5. “[Fentanyl_Transdermal_System_50_mcg_Patch.jpg](#)” by [User:Crohnie](#) is licensed under [CC BY-SA 3.0](#)



Figure 11.9 Fentanyl Patch

- ▶ Read more information about opioid medications in the [“Analgesic and Musculoskeletal”](#) chapter in the Open RN *Nursing Pharmacology, 2e* textbook.

Alternative Routes of Administration of Opioids

Analgesic medications can be administered via several routes, including orally, rectally, subcutaneously, and intravenously. Intramuscular routes are typically avoided. Other routes of administration include patient-controlled analgesia (PCA), intrathecally, and by epidural.

PATIENT-CONTROLLED ANALGESIA

Patient-controlled analgesia (PCA) is a method of pain management that allows hospitalized clients with severe pain to safely self-administer opioid medications using a programmed pump according to their level of

discomfort. See Figure 11.10⁶ for an image of a PCA pump. A computerized pump contains a syringe of pain medication and is connected directly to a client's intravenous (IV) line. Pain medication includes morphine, hydromorphone, and fentanyl. Doses of medication can be self-administered as needed by the client 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 client 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 client should press the button for administration of medication (not even the nurse.) Nurses closely monitor clients receiving PCA medications for respiratory depression and oversedation, including their respiratory rate, SpO₂, sedation level, and mental status.

In other cases, the PCA pump delivers a small, continuous flow of pain medication intravenously with the option of the client self-delivering additional medication as needed, according to the limits set on the pump.

To document the amount and frequency of pain medication the client is receiving, as well as to prevent drug diversion, the settings on the pump are checked at the end of every shift 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. The PCA pump is locked with a special key to keep the medication secure.

6. "alaris-pca-module-IF-0518-0034" by unknown author used on the basis of Fair Use. Access original image at <https://www.bd.com/en-us/products-and-solutions/products/product-families/bd-alaris-pca-module>.



Figure 11.10 PCA Pump. Used under Fair Use.

INTRATHECAL PUMP

Another type of pump used to deliver pain medication is the intrathecal pump. This pump is surgically implanted under the skin and delivers small quantities of pain medication, such as morphine, directly into the spinal fluid. It is used to treat pain and muscle spasticity when other methods have not effectively treated the pain. It is typically used for clients with severe chronic pain, such as cancer pain, back pain, or nerve pain. However, the FDA urges cautious use because it has received numerous Medical Device Reports (MDRs) describing adverse events with implanted pumps. These reports describe pump failures, dosing errors, and other potential safety issues. Client symptoms described in these reports include pain, opioid withdrawal, fever,

vomiting, muscle spasm, cognitive changes, weakness, and cardiac and respiratory distress.⁷

EPIDURAL

A third route of alternative administration of pain medication is epidural anesthesia. See Figure 11.11⁸ for an image of an epidural anesthesia. Morphine is administered into the spinal fluid via an epidural catheter for severe pain management associated with surgical procedures or during labor and delivery. It is also used to treat chronic pain that has not responded to other treatments. Epidural administration of five mg of morphine provides adequate postoperative analgesia for up to 24 hours.⁹

7. U.S. Food & Drug Administration. (2018). *Use caution with implanted pumps for intrathecal administration of medicines for pain management: FDA safety communication*. <https://www.fda.gov/medical-devices/safety-communications/use-caution-implanted-pumps-intrathecal-administration-medicines-pain-management-fda-safety>

8. “Epidural_Anesthesia.png” by [BruceBlaus](#) is licensed under [CC BY-SA 4.0](#)

9. Martinez-Velez, A. (2023). *Epidural morphine*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK541073/>

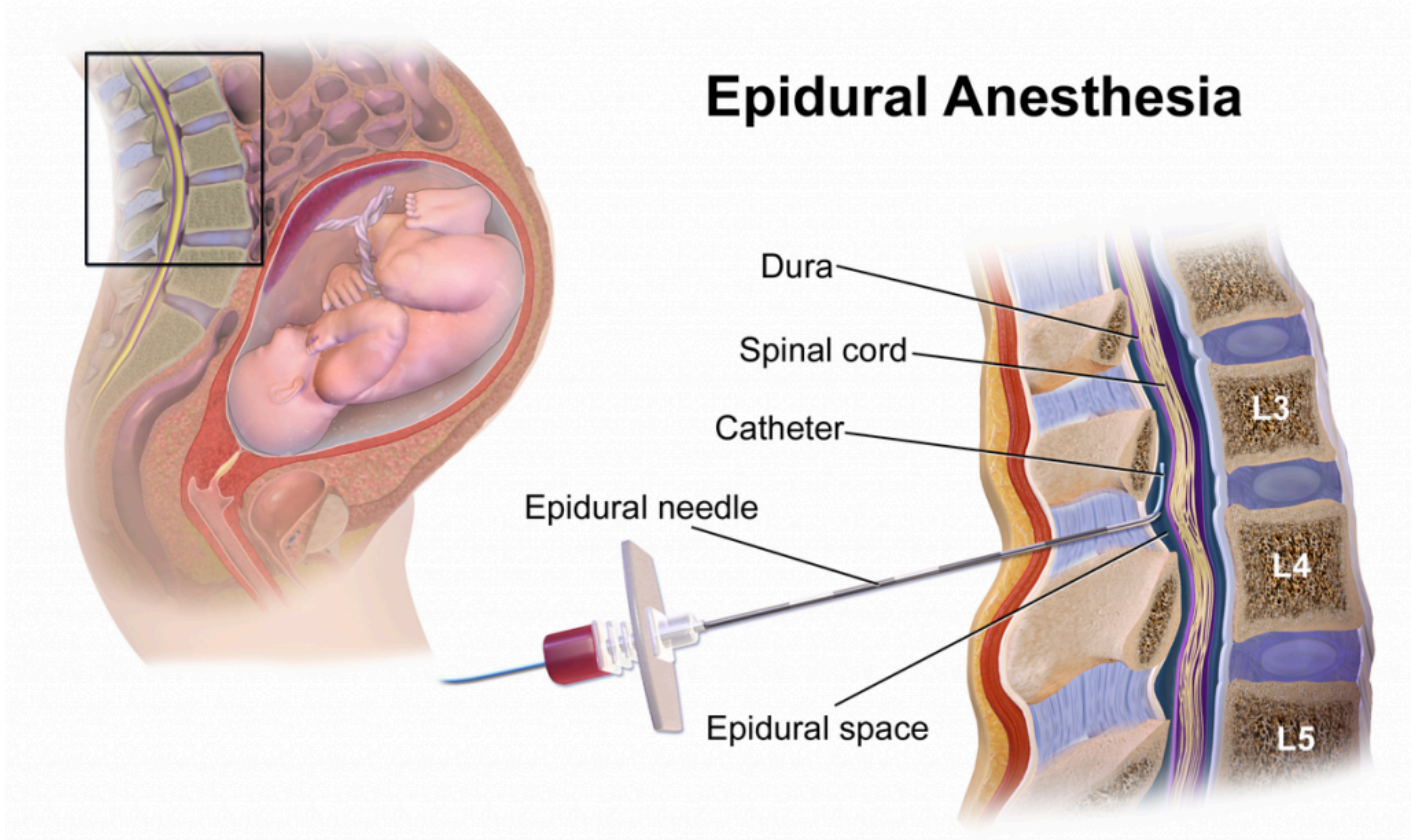


Figure 11.11 Epidural

Adverse Effects of Opioids

RESPIRATORY DEPRESSION

The most serious potential adverse effect of opioids is respiratory depression. Respiratory depression is usually preceded by sedation. The nurse must carefully monitor clients receiving opioids for oversedation, which results in decreased respiratory rate. Clients 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 client develops opioid-induced respiratory depression, the opioid is reversed with naloxone that immediately reverses all

analgesic effect.¹⁰ Nurses should be aware that if a client is physically dependent on opioids, the administration of naloxone will cause immediate and severe withdrawal symptoms such as nausea, vomiting, diarrhea, and tremors. See Figure 11.12¹¹ for an image of a naloxone rescue kit to treat respiratory depression caused by opioids.



Figure 11.12 Naloxone Rescue Kit

Opioids can cause several other common adverse effects, such as constipation, nausea and vomiting, urinary retention, and pruritus (itching).

CONSTIPATION

Opioids slow peristalsis and cause increased reabsorption of fluid into the large intestine, resulting in slow-moving, hard stools. Nurses play an important role in preventing constipation for all clients taking opioids. A bowel management program should be initiated with the first dose and continued until the opioid is discontinued. A stool softener (such as docusate) is typically prescribed initially as part of the bowel management program. If

10. American Association of Colleges of Nursing. (n.d.). *End-of-life-care (ELNEC)*. <https://www.aacnnursing.org/ELNEC>

11. "Opiod_Rescue_Kit_3.jpg" by Intropin (Mark Oniffrey) is licensed under [CC BY_SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/)

needed, a stimulant laxative, such as sennoside (Senna), bisacodyl, or Milk of Magnesia may be added to maintain a normal bowel pattern. However, stimulants should not be taken long-term because they can be addictive. Clients taking opioids should be encouraged to increase fluid and fiber intake and ambulate, as appropriate.¹²

NAUSEA AND VOMITING

Nausea and vomiting can occur with opioid administration due to several factors, such as the slowing of gastrointestinal motility, constipation, or stimulation of the vestibular system. Tolerance will develop to these adverse effects within a few days. Treatment includes antiemetics, such as compazine or ondansetron.¹³

URINARY RETENTION

Urinary retention is common in opioid-naive clients or when opioids are delivered via the spinal route. Urinary catheterization may be required if the client is unable to void. Tolerance to this effect occurs within a few days.¹⁴

PRURITUS

Pruritus (itching) may occur, especially when opioids are administered via the spinal route. Antihistamines, such as diphenhydramine (Benadryl), may be

12. American Association of Colleges of Nursing. (n.d.). *End-of-life-care (ELNEC)*. <https://www.aacnnursing.org/ELNEC>

13. American Association of Colleges of Nursing. (n.d.). *End-of-life-care (ELNEC)*. <https://www.aacnnursing.org/ELNEC>

14. American Association of Colleges of Nursing. (n.d.). *End-of-life-care (ELNEC)*. <https://www.aacnnursing.org/ELNEC>

used to treat pruritus, but the client should be monitored for potential sedative effects of this medication.¹⁵

Adjuvant Medications

Adjuvants are medications that are not classified as analgesics but have been found to contribute to analgesic effects, especially when used in addition to opioids. Two common examples of adjuvant medications are amitriptyline and gabapentin.

AMITRIPTYLINE

Amitriptyline is a tricyclic antidepressant that is also believed to be effective in treating neuropathic pain, such as diabetic neuropathy, postherpetic neuralgia, or post-stroke pain. The mechanism of action of amitriptyline in the treatment of neuropathic pain remains uncertain, although it is known to inhibit both serotonin and noradrenaline reuptake. It is usually administered at bedtime in an attempt to reduce any sedative effects during the day.¹⁶

GABAPENTIN

Gabapentin is an anticonvulsant that is also effective in treating neuropathic pain and restless leg syndrome. Clients taking gabapentin should be warned that their mental health may change in unexpected ways or they may become suicidal. Nurses should implement fall precautions for clients taking gabapentin because it can cause sleepiness, weakness, and unsteadiness.¹⁷

15. American Association of Colleges of Nursing. (n.d.). *End-of-life-care (ELNEC)*. <https://www.aacnnursing.org/ELNEC>

16. Moore, R. A., Derry, S., Aldington, D., Cole, P., & Wiffen, P. J. (2015). Amitriptyline for neuropathic pain in adults. *The Cochrane Database of Systematic Reviews*, 2015(7). <https://doi.org/10.1002/14651858.CD008242.pub3>

17. U.S. National Library of Medicine. (2020). *Gabapentin: Medlineplus drug*

Nonpharmacological Interventions

Nonpharmacological interventions can be used with or without pharmacologic interventions and often provide tremendous benefits to the client. A variety of techniques can be selected by the client that best fit their needs and goals. Nonpharmacological interventions should be documented in the plan of care and their effectiveness evaluated in terms of their ability to meet the client's goals for pain relief. Table 11.4b provides examples of several types of nonpharmacological interventions.

Table 11.4b Nonpharmacological Interventions

information. MedlinePlus. <https://medlineplus.gov/druginfo/meds/a694007.html>

Intervention	Examples
Distraction	Describing photos, telling jokes, and playing games
Relaxation	Rhythmic breathing, meditation, prayer, imagery, and music therapy
Basic comfort measures	Proper positioning and therapeutic environment Avoiding sudden movement Reducing pain stimuli within the environment
Cutaneous stimulation	Acupuncture and acupressure Massage: 3-5 minutes offers benefits Transcutaneous Electrical Nerve Stimulation (TENS) unit: A specialized stimulator placed over the area of pain
Application of heat or cold	Heat: Examples include heating pads and warm compresses. Vasodilation increases blood flow; duration should be 5-20 minutes based on client tolerance. Do not apply over medication patches or implanted devices. Cold: Examples include cool baths and moist, cool compresses. Vasoconstriction reduces blood flow; cold numbs nerve sensations; duration should be no longer than 20 minutes. Do not apply over medication patches or implanted devices.
Mind-body therapies	Biofeedback Meditation and mindfulness
Aromatherapy	Lotions and moisturizing cream Avoiding strong smells
Exercise	Physical activity Tai chi Yoga
Therapy	Physical therapy Occupational therapy

See Figure 11.13¹⁸ for images of various nonpharmacological interventions.



Figure 11.13 Nonpharmacological Interventions

18. “[Massage-hand-4.jpg](#)” by Lubyanka is licensed under [CC BY-SA 3.0](#), “[Biofeedback_training_program_for_post-traumatic_stress_symptoms.jpg](#)” by [Army Medicine](#) is licensed under [CC BY 2.0](#), “[Tai_Chi1.jpg](#)” by [Craig Nagy](#) is licensed under [CC BY-SA 2.0](#), “[Musicoterapia_Imidiman_flickr.jpg](#)” by [Midiman](#) is licensed under [CC BY 2.0](#), “[Cold_Hot_Pack.jpg](#)” by [Mamun2a](#) is licensed under [CC BY-SA 4.0](#), “[pexels-photo-1188511.jpeg](#)” by [Mareefe](#) is licensed under [CC0](#), “[STOTT-PILATES-reformer-class.jpg](#)” by [MHandF](#) is licensed under [CC BY-SA 3.0](#), “[prayer-2544994_960_720.jpg](#)” by [Himsan](#) is licensed under [CC0](#), and “[gaming-2259191_960_720.jpg](#)” by [JESHOOOTS-com](#) is licensed under [CC0](#)

Clients may also consider using complementary health approaches to manage chronic pain. Complementary approaches include acupuncture, massage therapy, meditation, relaxation techniques, spinal manipulation, Tai Chi, yoga, and dietary supplements. Read more about complementary approaches provided in the following box.

- ▶ Read The Joint Commission document on "[Non-pharmacologic and non-opioid solutions for pain management.](#)"
- ▶ Read more about [complementary approaches](#) to treat pain from the National Center for Complementary and Integrative Health.
- ▶ Read about [pain management for older adults](#) from the University of Iowa.

11.5 Applying the Nursing Process

OPEN RESOURCES FOR NURSING (OPEN RN)

Assessment

Nurses play an essential role in performing comprehensive pain assessments. Assessments include asking questions about the presence of pain, as well as observing for nonverbal indicators of pain, such as grimacing, moaning, and touching the painful area. It is especially important to observe for nonverbal indicators of pain in clients unable to self-report their pain, such as infants, children, clients who have a cognitive disorder, client at end of life, non-English-speaking clients, or clients who tend to be stoic due to cultural beliefs. See Figure 11.14¹ for an image of a simulated client who is expressing pain nonverbally.

1. "[238074231_2485ed053b_o](#)" by [Erik Ogan](#) is licensed under [CC BY-SA 2.0](#)



Figure 11.14 Nonverbal Expression of Pain

Recall that pain is defined as whatever the person experiencing it says it is. Subjective assessment includes asking questions regarding the severity rating, as well as obtaining comprehensive information by using standard measures like PQRSTU or OLDCARTES for assessing a chief complaint. For some clients who are unable to quantify the severity of their pain, visual scales like the FACES scale are the best way to perform subjective assessment regarding the severity of pain. Review the PQRSTU, OLDCARTES, FACES, and other pain assessment scales in the [“Pain Assessment Methods”](#) section of this chapter.

Objective data includes observations of nonverbal indications of pain, such as restlessness, facial grimacing and wincing, moaning, and rubbing or guarding painful areas. For clients who cannot verbalize their pain, using a scale like the FLACC, COMFORT, or PAINAD is helpful to standardize observations across different staff members. Keep in mind that clients experiencing acute pain will also likely have vital signs changes, such as increased blood pressure, increased heart rate, and increased respiratory rate.

It is important to assess the impact of pain on a client’s daily functioning. This can be accomplished by asking what effect the pain has on their ability

to bathe, dress, prepare food, eat, walk, and complete other daily activities. Assessing the impact of pain on daily functioning is a new standard of care that assists the interdisciplinary team in tailoring treatment goals and interventions that are customized to the client's situation. For example, for some clients, chronic pain affects their ability to be employed, so effective pain management is vital so they can return to work. For other clients receiving palliative care, the ability to sit up and eat a meal with loved ones without pain is an important goal.²

When performing a client assessment, any new complaints of pain or pain that is unresponsive to the current treatment plan should be reported to the health care provider. Instances of sudden, severe pain or chest pain/pressure require immediate notification or contact of emergency services.

Diagnoses

Commonly used NANDA-I nursing diagnoses for pain include *Acute Pain* (duration less than three months) and *Chronic Pain*. See Table 11.5 for more information regarding these diagnoses.³ For more information about defining characteristics and related factors for other NANDA-I nursing diagnoses, refer to a current nursing diagnosis resource.

Table 11.5 Pain NANDA-I Nursing Diagnoses⁴

2. American Association of Colleges of Nursing. (n.d.). *End-of-life-care (ELNEC)*. <https://www.aacnnursing.org/ELNEC>
3. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.
4. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.

NANDA-I Diagnosis	Definition	Selected Defining Characteristics
Acute Pain	Unpleasant sensory and emotional experience associated with acute or potential tissue damage or described in terms of such damage; sudden or slow onset of any intensity from mild to severe with an anticipated or predictable end, and with a duration of less than three months.	<ul style="list-style-type: none"> • Appetite change • Altered physiological parameters (i.e., blood pressure, heart rate, respiratory rate) • Diaphoresis • Distraction behavior • Evidence of pain using standardized pain behavior checklist for those unable to communicate verbally • Expressive behavior • Facial expression of pain • Guarding behavior • Hopelessness • Narrow focus • Positioning to ease pain • Protective behavior • Proxy report of pain behavior/activity changes • Pupil dilation • Self-focused

Chronic Pain	Unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage (International Association for the Study of Pain); sudden or slow onset of any intensity from mild to severe, constant or recurring without anticipated or predictable end, and with a duration of greater than three months.	<ul style="list-style-type: none"> • Altered ability to continue activities • Anorexia • Evidence of pain using standardized pain behavior checklist for those unable to communicate verbally • Facial expression of pain • Proxy report of pain behavior/activity changes • Reports altered sleep-wake cycle • Self-focused
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Outcome Identification

An overall goal when providing pain management is, *“The client will report that the pain management treatment plan achieves their comfort-function goals.”*⁵

SMART outcomes are customized to the client’s unique situation. An example of a SMART goal is, *“The client will notify the nurse promptly for pain intensity level that is greater than their comfort-function goal throughout shift.”*⁶

5. Ackley, B., Ladwig, G., Makic, M. B., Martinez-Kratz, M., & Zanotti, M. (2020). *Nursing diagnosis handbook: An evidence-based guide to planning care* (12th ed.). Elsevier, pp. 676-691.

6. Ackley, B., Ladwig, G., Makic, M. B., Martinez-Kratz, M., & Zanotti, M. (2020). *Nursing diagnosis handbook: An evidence-based guide to planning care* (12th ed.). Elsevier, pp. 676-691.

Planning Interventions

Several pharmacological and nonpharmacological interventions have been described throughout this chapter. See the following box for a summarized list of interventions for acute pain management.

Acute Pain Management⁷

- Identify pain intensity during required recovery activities (e.g., coughing and deep breathing, ambulation, transfers to chair, etc.)
- Explore client's knowledge and beliefs about pain, including cultural influences
- Question client regarding the level of pain that allows a state of comfort and desired function and attempt to keep pain at or lower than their identified level
- Ensure that the client receives prompt analgesic care before the pain becomes severe or before pain-inducing activities
- Administer analgesics around-the-clock as needed the first 24 to 48 hours after surgery, trauma, or injury except if sedation or respiratory status indicates otherwise
- Monitor sedation and respiratory status before administering opioids and at regular intervals when opioids are administered
- Follow agency protocols in selecting analgesia and dosage
- Use a combination of prescribed medications (e.g.,

7. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.

- opioids, nonopioids, and adjuvants), if pain level is severe
- Select and implement interventions tailored to the client's risks, benefits, and preferences (e.g., pharmacological and nonpharmacological) to facilitate pain relief
 - Cautiously use analgesics that may have adverse effects in older adults
 - Administer analgesics using the least invasive route available, avoiding the intramuscular route
 - Advocate PCA, intrathecal, and epidural routes of administration when appropriate
 - Modify pain control measures on the basis of the client's response to treatment
 - Prevent and/or manage medication side effects
 - Notify prescribing provider if pain control measures are unsuccessful
 - Provide accurate information to family members or caregivers about the client's pain experience with the client's permission

See the following box for a summarized list of interventions for chronic pain management.

Chronic Pain Management⁸

8. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.

- Explore the client's knowledge and beliefs about pain, including cultural influences
- Determine the pain experience on quality of life (e.g., sleep, appetite, activity, cognition, mood, relationships, job performance, and role responsibilities)
- Evaluate the effectiveness of past pain control measures with the client
- Question the client regarding the level of pain that allows a state of comfort and appropriate functioning and attempt to keep pain at or lower than identified level
- Control environmental factors that may influence the client's pain experience
- Ensure that the client receives prompt analgesic care before the pain becomes severe or before activities that are anticipated to be pain-inducing
- Select and implement intervention options tailored to the client's risks, benefits, and preferences (e.g., pharmacological, nonpharmacological, interpersonal) to facilitate pain relief, as appropriate
- Instruct the client and family about principles of pain management
- Encourage the client to monitor own pain and to use self-management approaches
- Encourage appropriate use of nonpharmacological techniques (e.g., biofeedback, TENS, hypnosis, relaxation, guided imagery, music therapy, distraction, play therapy, activity therapy, acupressure, heat and cold application, and massage) and pharmacological options as pain control measures
- Avoid use of analgesics that may have adverse effects on older adults

- Collaborate with the client, family, and other health professionals to select and implement pain control measures
- Prevent or manage side effects
- Evaluate the effectiveness of pain control measures through ongoing monitoring of the pain experience
- Watch for signs of depression (e.g., sleeplessness, not eating, flat affect, statements of depression, or suicidal ideation)
- Watch for signs of anxiety or fear (e.g., irritability, tension, worry, or fear of movement)
- Modify pain control measures on the basis of the client's response to treatment
- Incorporate the family in the pain relief modality, when possible
- Utilize a multidisciplinary approach to pain management, when appropriate
- Consider referrals for the client and family to support groups and other resources, as appropriate
- Evaluate client satisfaction with pain management at specified intervals
- Evaluate barriers to adherence with past pain management care plans

Implementing Pharmacological Interventions

Clients should be involved and engaged in their plan of care to treat pain. By demonstrating empathy and collaborating with clients and the interdisciplinary team, it is more likely the treatment plan will be effective based on the client's goals.

When administering analgesic medication, holistic nursing care is

important. Begin by considering the client's goals for pain relief and ask if they have been met effectively by previously administered medications. If they have not been met, it may be necessary to advocate for additional or alternative medication with the health care provider. It is also important to consider if the client is experiencing any side effects that may impact the client's desire to take additional pain medication.

When administering medications that have been ordered on an “as-needed” basis, it is vital for the nurse to verify the amount of medication the client received in the past 24 hours and if any dosage limits have been met to ensure client safety.

Prior to administration, consider the best route of administration for this client at this particular time. For example, if the client is nauseated and vomiting, then an oral route may not be effective. On the other hand, if a client's pain has improved when receiving intravenous medications during the recovery process, it may be possible for the client to begin taking oral pain medications in preparation for discharge home. Keep the WHO ladder in mind when selecting medications to reach client goals while also avoiding potential adverse effects when possible.

When preparing opioid medications, it is important to remember that these medications are controlled substances with special regulations regarding storage, count auditing, and disposal/wasting of medication. This generally involves two registered nurses counting, auditing, and wasting medications. Follow agency policy regarding these issues. It is also important to assess the client's level of sedation and respiratory status before administering additional doses of opioids and withhold the medication if the client is oversedated or their respiratory rate is less than 12/minute. However, when providing pain management during end-of-life care, these parameters no longer apply because the emphasis is on providing comfort according to the client's preferences. Read more about end-of-life care in the “[Grief and Loss](#)” chapter.

Evaluation

It is vital for the nurse to regularly evaluate if the established interventions are effectively meeting the pain management and function goals established

collaboratively with the client. Additionally, when administering analgesics, the client should be reassessed in an hour (or other time frame based on the route, onset and peak of the medication) to determine if the medication was effective. If interventions are not effective, then follow-up interventions are required, which may include contacting the health care provider.

For clients living with chronic pain, it can be helpful for them or their caregiver to maintain a pain journal. In the journal they can document activities that precipitated pain, medications taken to manage the pain, and whether these medications were effective in helping them to meet their functional goals. This journal is shared with the health care provider during follow-up visits to enhance the treatment plan.⁹

The nurse must continually monitor for potential adverse effects of pain medications. For example, if a client is receiving acetaminophen daily for chronic osteoarthritis pain, signs of liver dysfunction, such as jaundice and elevated liver function bloodwork, should be monitored. For older adults receiving NSAIDs, it is important to watch for early signs of gastrointestinal bleeding, such as melena. Clients receiving opioids should be continually monitored for oversedation, respiratory depression, constipation, nausea and vomiting, urinary retention, and pruritus. Side effects should be reported to the health care provider and orders received for treatment.

9. American Association of Colleges of Nursing. (n.d.). *End-of-life-care (ELNEC)*. <https://www.aacnnursing.org/ELNEC>

11.6 Putting It All Together

Client Scenario

Mrs. Jamison is a 34-year-old woman admitted through the emergency department with kidney stones. As you reposition her in bed, she is visibly grimacing and audibly moaning. She rates her pain at an “8 out of 10” although she reports her pain has “improved” since admission with the IV morphine delivered via PCA pump. You recheck her vital signs, and her blood pressure is elevated at 150/90 and her heart rate is 120.

Applying the Nursing Process

Assessment: The nurse notes that Mrs. Jamison demonstrates signs of discomfort with visible grimacing, audible moaning, and elevated blood pressure and heart rate. She rates her pain at “8 out of 10.”

Based on the assessment information that has been gathered, the following nursing care plan is created for Mrs. Jamison.

Nursing Diagnosis: *Acute Pain related to physical injury agent as evidenced by change in physiological parameters and self-report of pain rated as “8 out of 10.”*

Overall Goal: *The client will report that the pain management treatment plan achieves her comfort-function goal.*

SMART Expected Outcomes:

- *Mrs. Jamison will verbalize pain reduction to a self-reported tolerable level of “4” or less on a 0-10 scale by the end of the shift.*
- *Mrs. Jamison’s blood pressure and heart rate will return to baseline levels by the end of the shift.*

Planning and Implementing Nursing Interventions:

The nurse will perform a comprehensive pain assessment and identify the client’s expectation regarding pain management. The nurse will encourage

the client to use breathing techniques and relaxation methods to facilitate pain management. The nurse will notify the provider of unrelieved pain and request additional prescriptions for medication as needed.

Sample Documentation:

Mrs. Jamison was admitted with acute pain related to kidney stones and is receiving morphine via PCA pump. At 1400, her blood pressure was elevated at 150/90, and her heart rate elevated at 120. She reported pain as an “8 out of 10.” She was visibly grimacing and audibly moaning when repositioned in bed. Dr. Smith was notified at 1400 and a new prescription received. Ketorolac 30 mg IV was administered at 1415. At 1515, the client stated her pain had decreased to a “3 out of 10” level and this level was “satisfactory.” Her blood pressure also decreased to 135/76, and her heart rate decreased to 88.

Evaluation:

Within one hour of administration of Ketorolac, Mrs. Jamison verbalized pain reduction to her reported satisfactory level of “3,” and her blood pressure and heart rate decreased to her baseline levels. SMART outcomes were “met.”

11.7 Learning Activities

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Activities

(Answers to “Learning Activities” can be found in the “Answer Key” at the end of the book. Answers to interactive activity elements will be provided within the element as immediate feedback.)

Apply the concepts you learned from this chapter to the following client scenario:



Figure 11.15 Simulated Client

Mr. Jones is a 67-year-old male who was recently diagnosed with colon cancer last week and underwent a colon resection three

days ago. See Figure 11.15 for an image of Mr. Jones.¹ In the change of shift report, you hear that he is receiving morphine by PCA pump for pain, but he is not using it very often. Staff reports he “needs much encouragement” to get out of bed and participate in self-cares. He has crackles in his lung bases and his oxygen saturation is 88% on room air.

1. What additional assessments (subjective and objective) will you perform for the client and why?
2. List the top three priority nursing diagnoses for Mr. Jones.
3. Mr. Jones states, “I don’t want to use morphine. I am afraid I will become addicted to it like my friend did after he came home from the war.” How will you respond to therapeutically address his concerns, yet also teach the client about good pain management?
4. What are common side effects of opioids and how will you plan to manage these side effects?
5. Emotional issues could also be affecting Mr. Jones’ perception of pain. What will you further physically assess and therapeutically address?
6. After providing client education about morphine and the PCA pump, you check on Mr. Jones later in the day and notice he has had five self-doses every hour with 15 attempts in the past hour. The pump is set for a maximum of six doses per hour. What further assessments will you perform?

1. “Male_older_adult.jpg” by Shane VanderBent, [Chippewa Valley Technical College](#) is licensed under [CC BY 4.0](#)



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=1644#h5p-59>



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<https://wtcs.pressbooks.pub/nursingfundamentals/?p=1644#h5p-28>



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<https://wtcs.pressbooks.pub/nursingfundamentals/?p=1644#h5p-29>



Test your knowledge using this [NCLEX Next Generation-style](#)

▶ [bowtie question](#). You may reset and resubmit your answers to this question an unlimited number of times.²

2. “[Chapter 11 Assignment 1](#)” by Tami Davis for [OpenRN](#) is licensed under [CC BY-NC 4.0](#)

XI Glossary

OPEN RESOURCES FOR NURSING (OPEN RN)

Acute pain: Pain that is limited in duration and is associated with a specific cause. ([Chapter 11.2](#))

Addiction: A term used in many countries to describe severe problems related to compulsive and habitual use of substances. However, it is no longer a diagnosis by the American Psychiatric Association because of its potentially negative connotation.¹ ([Chapter 11.2](#))

Adjuvant: Medication that is not classified as an analgesic but has been found in clinical practice to have either an independent analgesic effect or additive analgesic properties when administered with opioids. ([Chapter 11.4](#))

Analgesics: Medications used to relieve pain. ([Chapter 11.4](#))

Chronic pain: Pain that is ongoing and persistent for longer than six months. ([Chapter 11.2](#))

Misuse: Taking prescription pain medications in a manner or dose other than prescribed; taking someone else's prescription, even if for a medical complaint such as pain; or taking a medication to feel euphoria (i.e., to get high). ([Chapter 11.2](#))

Nociceptor: A sensory receptor for painful stimuli. ([Chapter 11.2](#))

Opioid intoxication: Significant behavioral or psychological changes (e.g., apathy, dysphoria, psychomotor agitation or retardation, or impaired judgment) that occur during or shortly after opioid use. Symptoms of opioid intoxication include drowsiness or coma, slurred speech, or impairment in attention or memory. ([Chapter 11.2](#))

Overdose: The biological response of the human body when too much of a substance is ingested. ([Chapter 11.2](#))

1. American Psychiatric Association. (2022). *Desk reference to the diagnostic criteria from DSM-5-TR*.

Pain: An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage. ([Chapter 11.2](#))

Patient-Controlled Analgesia (PCA): A method of pain management that allows hospitalized clients with severe pain to safely self-administer opioid medications using a programmed pump according to their level of discomfort. ([Chapter 11.4](#))

Physical dependence: Withdrawal symptoms that occur when chronic pain medication is suddenly reduced or stopped because of physiological adaptations that occur from chronic exposure to the medication. ([Chapter 11.2](#))

Referred pain: Pain 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. ([Chapter 11.2](#))

Substance use disorder: An illness caused by repeated misuse of substances (including opioids). When taken in excess, these substances have a common effect of directly activating the brain reward system and producing such an intense activation of the reward system that normal life activities may be neglected. ([Chapter 11.2](#))

Tolerance: A diminished effect with continued use of the same amount of an opioid, or a need for increased amounts of opioids to achieve the desired effect or intoxication. ([Chapter 11.2](#))

Withdrawal: Symptoms that cause significant distress after stopping or reducing the use of substances (including opioids), with symptoms such as dysphoric mood, nausea, vomiting, muscle aches, rhinorrhea or lacrimation, pupillary dilation, piloerection, sweating, diarrhea, yawning, fever, or insomnia. ([Chapter 11.2](#))

PART XII

SLEEP AND REST

12.1 Sleep & Rest

Introduction

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Objectives

- Identify factors putting clients at risk for sleep and rest problems across the life span
- Identify cues related to sleep and rest problems
- Identify nonpharmacological interventions to promote sleep and rest
- Contribute to a plan of care for clients with sleep and rest alterations

Maslow's Hierarchy of Needs indicates sleep as one of our physiological requirements. Getting enough quality sleep at the right times according to our circadian rhythms can protect mental and physical health, safety, and quality of life. Conversely, chronic sleep deficiency increases the risk of heart disease, kidney disease, high blood pressure, diabetes, and stroke, as well as weakening the immune system.¹ This chapter will review the physiology of

1. Trossman, S. (2018). Nurses offer strategies to promote patients' rest and sleep. *American Nurse*. <https://www.myamericannurse.com/strategies-promote-patients-rest-sleep/>

sleep and common sleep disorders, as well as interventions to promote good sleep.

12.2 Basic Concepts

OPEN RESOURCES FOR NURSING (OPEN RN)

What Causes Sleep?

There are two internal biological mechanisms that work together to regulate wakefulness and sleep referred to as circadian rhythms and sleep-wake homeostasis.

Circadian rhythms direct a wide variety of body functions, including wakefulness, core temperature, metabolism, and the release of hormones. They control the timing of sleep, causing a person to feel sleepy at night and creating a tendency to wake in the morning without an alarm. See Figure 12.1¹ for an illustration of circadian rhythms. Circadian rhythms are based roughly on a 24-hour clock and use environmental cues, such as light and temperature to determine the time of day.²

Sleep-wake homeostasis keeps track of a person's need for sleep. A pressure to sleep builds with every hour that a person is awake, reaching a peak in the evening when most people fall asleep. The homeostatic sleep drive also regulates sleep intensity, causing a person to sleep longer and more deeply after a period of sleep deprivation.³ Adenosine is linked to this drive for

1. "[The master circadian clock in the human brain.jpg](#)" by Ian B. Hickie, Sharon L. Naismith, Rébecca Robillard, Elizabeth M. Scott, and Daniel F. Hermens is licensed under [CC BY 3.0](#)

2. National Institute of Neurological Disorders and Stroke. (2024). *Understanding sleep*. U.S. Department of Health & Human Services. <https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Understanding-Sleep>

3. National Institute of Neurological Disorders and Stroke. (2024).

sleep. While awake, the level of adenosine in the brain continues to rise, with increased levels signaling a shift toward sleep. While sleeping, the body breaks down adenosine. When it gets dark, the body also releases a hormone called melatonin. Melatonin signals the body that it's time to prepare for sleep and creates a feeling of drowsiness. The amount of melatonin in the bloodstream peaks as the evening wears on. A third hormone, cortisol, is released in the early morning hours and naturally prepares the body to wake up.⁴

Factors that influence a person's sleep and wakefulness include medical conditions, medications, stress, sleep environment, and foods and fluids consumed, but the greatest influence is exposure to light. Specialized cells in the retina process light and provide messages to the brain to align the body clock with periods of day or night. Exposure to bright artificial light in the late evening can disrupt this process, making it hard to fall asleep. Examples of bright artificial light include the light from a TV screen, computer, or smartphone. Exposure to light can also make it difficult to return to sleep after being awakened.⁵

Understanding sleep. U.S. Department of Health & Human Services.
<https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Understanding-Sleep>

4. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency.* U.S. Department of Health & Human Services.
<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

5. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency.* U.S. Department of Health & Human Services.
<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

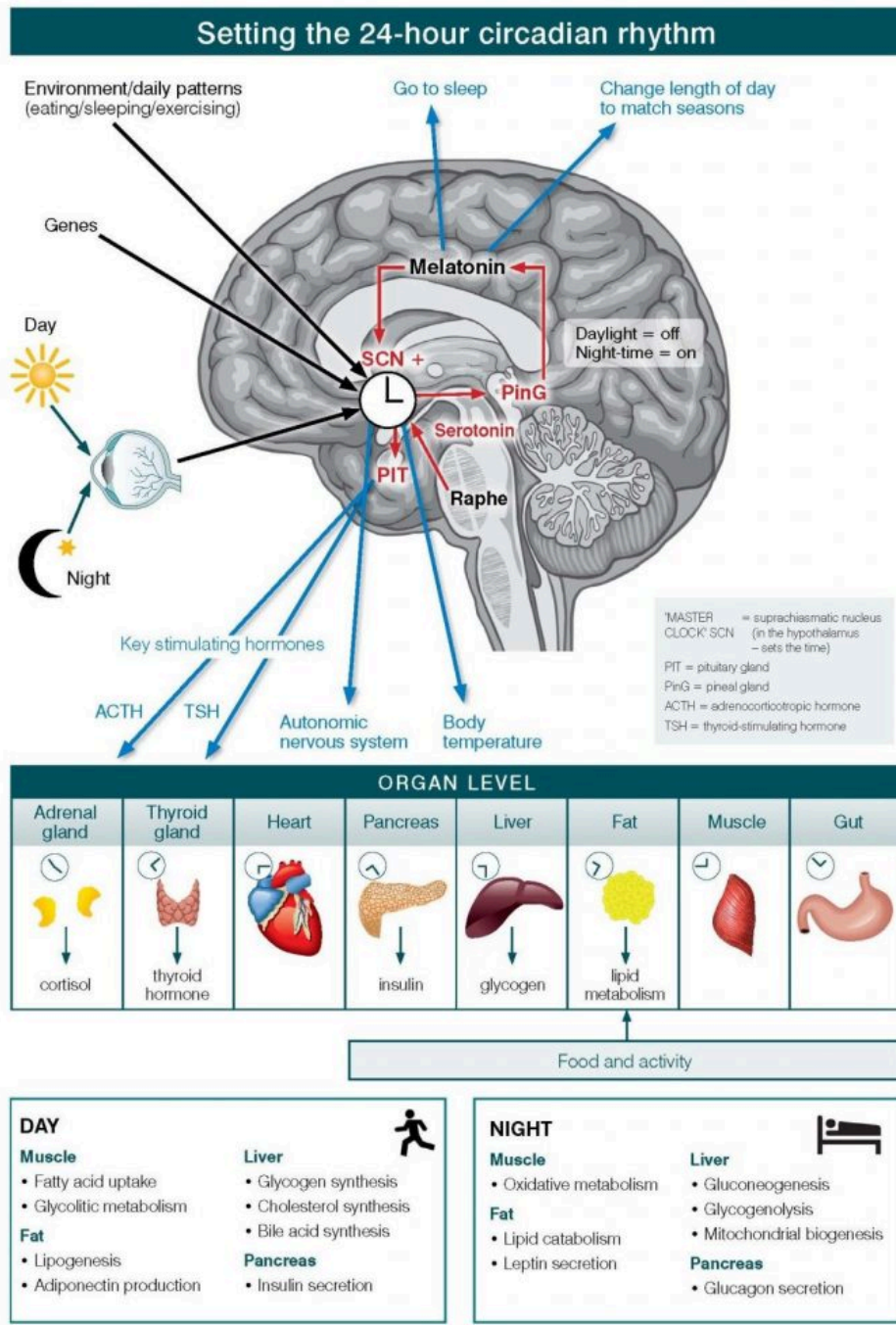


Figure 12.1 Circadian Rhythms

Night shift workers often have trouble falling asleep when they go to bed and may have trouble staying awake at work because their natural circadian rhythm and sleep-wake cycle are disrupted. Jet lag also disrupts circadian

rhythms. When flying to a different time zone, a mismatch is created between a person's internal clock and the actual time of day.⁶

The rhythm and timing of the body clock change with age. For example, teenagers fall asleep later at night than younger children and adults because melatonin is released and peaks later in the 24-hour cycle for teens. As a result, it's natural for many teens to prefer later bedtimes at night and sleep later in the morning than adults.⁷

Individuals also need more sleep early in life, when they're growing and developing. For example, newborns may sleep more than 16 hours a day, and preschool-aged children need to take naps. Young children tend to sleep more in the early evening whereas older adults tend to go to bed earlier and wake up earlier.⁸

Sleep Phases and Stages

When sleeping, individuals cycle through two phases of sleep: rapid eye movement (REM) and non-REM sleep. A full sleep cycle takes 80 to 100 minutes to complete, and most people typically cycle through four to six cycles per night. It is common to wake up briefly between cycles.⁹

6. National Institute of Neurological Disorders and Stroke. (2024). *Understanding sleep*. U.S. Department of Health & Human Services. <https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Understanding-Sleep>
7. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>
8. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>
9. National Heart, Lung, and Blood Institute. (2022). *How sleep works*. U.S.

Restoration takes place mostly during slow-wave **non-REM** sleep, during which the body's temperature, heart rate, and brain oxygen consumption decrease. Brain activity decreases, so this stage is also referred to as slow-wave sleep and is observed during sleep studies. Non-REM sleep has these three stages:

- **Stage 1:** The transition between wakefulness and sleep.
- **Stage 2:** The initiation of the sleep phase.
- **Stage 3:** The deep sleep or slow-wave sleep stage based on a pattern that appears during measurements of brain activity. Individuals spend the most amount of sleep time in this stage during the early part of the night. (Note that the previously considered fourth stage of non-REM sleep is now included within Stage 3).¹⁰

During **REM** sleep, a person's heart rate and respiratory rate increase. Eyes twitch as they rapidly move back and forth and the brain is active. Brain activity measured during REM sleep is similar to activity during waking hours. Dreaming occurs during REM sleep, and muscles normally become limp to prevent acting out one's dreams. People typically experience more REM sleep as the night progresses. However, hot and cold environments can affect a person's REM sleep because the body does not regulate temperature well

Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/how-sleep-works>

10. National Heart, Lung, and Blood Institute. (2022). *How sleep works*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/how-sleep-works>

during REM sleep.¹¹ See Figure 12.2¹² for an image illustrating stages of sleep with increased REM sleep through the night indicated in solid red lines.

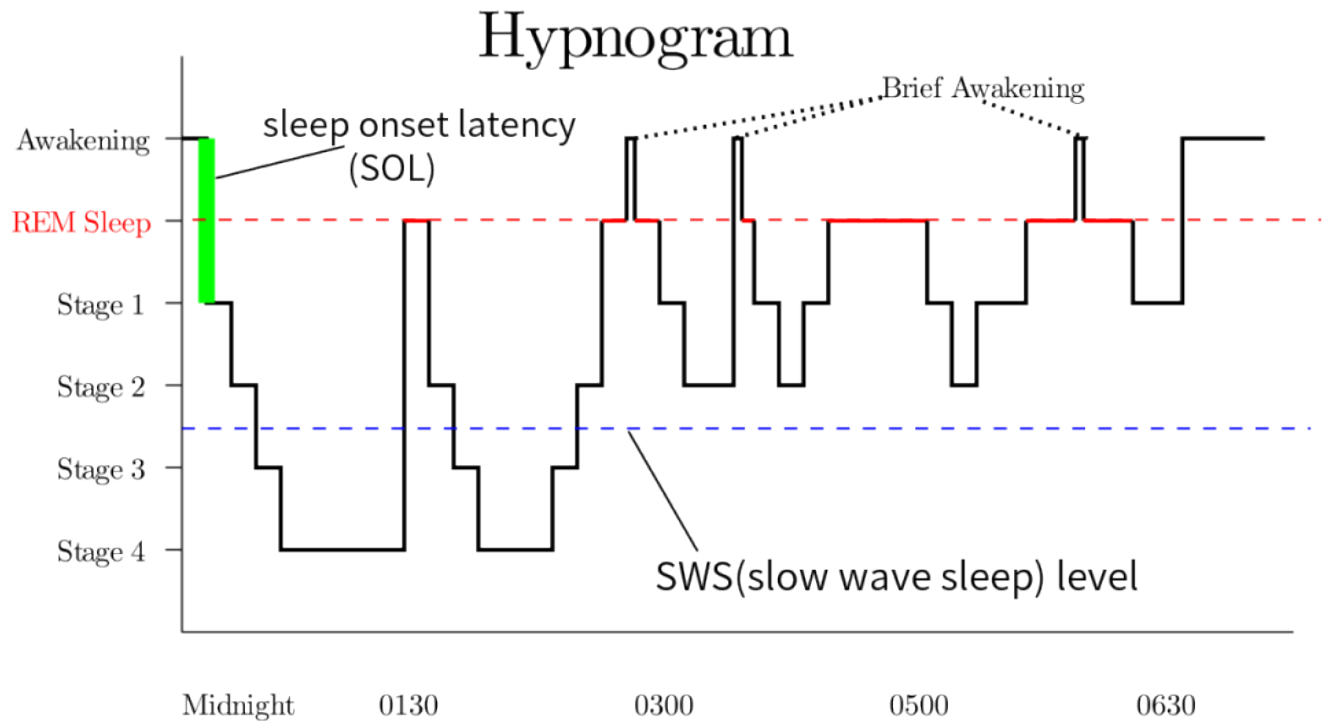


Figure 12.2 Stages of Sleep

The patterns and types of sleep change as people mature. For example, newborns spend more time in REM sleep. The amount of slow-wave sleep peaks in early childhood and then drops sharply in the teenage years. Slow-

11. National Heart, Lung, and Blood Institute. (2022). *How sleep works*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/how-sleep-works>

12. "The master circadian clock in the human brain.jpg" by Ian B. Hickie, Sharon L. Naismith, Rébecca Robillard, Elizabeth M. Scott, and Daniel F. Hermens is licensed under [CC BY 3.0](https://creativecommons.org/licenses/by/3.0/)

wave sleep continues to decrease through adulthood, and older people may not have any slow-wave sleep at all.¹³

Why Is Sleep Important?

Sleep plays a vital role in good health and well-being. Getting enough quality sleep at the right times protects mental health and physical health. Lack of sleep affects daytime performance, quality of life, and safety. The way a person feels while awake depends on what happens while they are sleeping. During sleep, the body is working to support healthy brain function and maintain physical health. In children and teens, sleep also helps support growth and development.¹⁴

Healthy Brain Function and Emotional Well-Being

Sleep helps the brain work properly. While sleeping, the brain is forming new pathways to help a person learn and remember information. Studies show that a good night's sleep improves learning and problem-solving skills. Sleep also helps a person pay attention, make decisions, and be creative. Conversely, sleep deficiency alters activity in some parts of the brain, causing difficulty in making decisions, solving problems, controlling emotions and behavior, and coping with change. Sleep deficiency has also been linked to depression, suicide, and risk-taking behavior.¹⁵

13. National Heart, Lung, and Blood Institute. (2022). *How sleep works*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/how-sleep-works>
14. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>
15. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and*

Physical Health

Sleep also plays an important role in physical health. For example, sleep is involved in healing and repairing the heart and blood vessels. Ongoing sleep deficiency is linked to an increased risk of heart disease, kidney disease, high blood pressure, diabetes, and stroke. Sleep helps maintain a healthy balance of the hormones that cause hunger (ghrelin) or a feeling of fullness (leptin). When a person doesn't get enough sleep, the level of ghrelin increases and the level of leptin decreases, causing a person to feel hungry when sleep deprived. The way the body responds to insulin is also affected, causing increased blood sugar.¹⁶

Sleep supports healthy growth and development. Deep sleep triggers the body to release hormones that promote normal growth in children and teens. See Figure 12.3.¹⁷ of a sleeping child. These hormones also boost muscle mass and help repair cells and tissues.¹⁸

deficiency. U.S. Department of Health & Human Services.

<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

16. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services.

<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

17. “6041578611_f2c9e4d164_k.jpg” by [rachel CALAMUSA](#) is licensed under [CC BY-SA 2.0](#)

18. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services.

<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>



Figure 12.3 Sleeping Child

Daytime Performance

Getting enough quality sleep at the right times also enhances functioning throughout the day. People who are sleep deficient are less productive at work and school. They take longer to finish tasks, have a slower reaction time, and make more mistakes. After several nights of losing sleep, even a loss of just one or two hours per night, the ability to function declines.¹⁹ See Figure 12.4²⁰ for an image of a student demonstrating sleep deficiency while studying.

¹⁹. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services.
<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

²⁰. “Study_sleep.jpg” by Nic Ashman, [Chippewa Valley Technical College](#) is licensed under [CC BY 4.0](#)



Figure 12.4 Sleep Deficiency

Lack of sleep can lead to microsleep. **Microsleep** refers to brief moments of sleep that occur when one is normally awake. You can't control microsleep, and you might not be aware of it. For example, have you ever driven somewhere and then not remembered part of the trip? If so, you may have experienced microsleep. Even if you're not driving, microsleep can affect how you function. If you're listening to a lecture, for example, you might miss some of the information or feel as if you don't understand the point. In reality, you may have slept through part of the lecture and not been aware of experiencing microsleep.²¹

Effects of Sleep Deficiency

The damage from sleep deficiency can occur in an instant. For example, drowsy drivers may feel capable of driving. Yet, studies show that sleep

21. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

deficiency harms one's driving ability as much as, or more than, being drunk. It is estimated that driver sleepiness is a factor in about 100,000 car accidents each year, resulting in about 1,500 deaths.²²

Drivers aren't the only ones affected by sleep deficiency. It can affect people in all lines of work, including health care workers, pilots, students, mechanics, and assembly line workers. As a result, sleep deficiency is harmful not only on a personal level, but also can cause large-scale damage. For example, sleep deficiency has played a role in human errors linked to tragic accidents, such as nuclear reactor meltdowns, grounding of large ships, and aviation accidents.²³

Sleep deficiency can also cause long-term harm. It increases the risk of obesity. For example, one study of teenagers showed that with each hour of sleep lost, the odds of becoming obese went up. Sleep deficiency increases the risk of obesity in other age groups as well. Sleep also affects how your body reacts to insulin, the hormone that controls your blood glucose (sugar) level. Sleep deficiency results in a higher than normal blood sugar level, which may increase your risk for diabetes. Ongoing sleep deficiency can also change the way in which your immune system responds. For example, if you're sleep deficient, you may have trouble fighting common infections. In addition, children and teens who are sleep deficient may have problems getting along with others. They may feel angry and impulsive, have mood swings, feel sad or depressed, or lack motivation. They also may have problems paying attention, and they may get lower grades and feel stressed.²⁴

22. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services.
<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

23. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services.
<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

24. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and*

If a person routinely loses sleep or chooses to sleep less than needed, the sleep loss adds up. The total sleep lost is called sleep debt. For example, if you lose 2 hours of sleep each night, you'll have a sleep debt of 14 hours after a week.²⁵ See Figure 12.5²⁶ of an individual feeling the effects of sleep debt on awakening.



Figure 12.5 Sleep Debt

Some people nap as a way to deal with sleepiness. Naps can provide a short-term boost in alertness and performance. However, napping doesn't provide restorative sleep. Some people sleep more on their days off than on workdays. They also may go to bed later and get up later on days off. Although extra

deficiency. U.S. Department of Health & Human Services.

<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

25. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services.

<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

26. "8609141689_ff923d2934_k.jpg" by [Navy_NADAP](#) is licensed under [CC BY-NC-ND 2.0](#)

sleep on days off might help a person feel better, it can upset the body's sleep-wake rhythm.²⁷ See Figure 12.6²⁸ of an adult napping during the day.



Figure 12.6 Napping

Sleep deficiency can affect people even when they sleep the total number of hours recommended for their age group. For example, people whose sleep is out of sync with their body clocks (such as shift workers) or whose sleep is routinely interrupted (such as caregivers or emergency responders) often need to pay special attention to their sleep needs. Individuals should also talk to a health care provider if they sleep more than eight hours a night, but don't feel well-rested. This can indicate a sleep disorder or other health problem.²⁹

27. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services.
<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

28. "Sleeping_man_J2.jpg" by Jamain is licensed under [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/)

29. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services.
<https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

Sleep Disorders

There are several sleep disorders that can cause sleep deficiency, such as insomnia, sleep apnea, and narcolepsy.

Insomnia

Insomnia is a common sleep disorder that causes trouble falling asleep, staying asleep, or getting good quality sleep. Insomnia interferes with daily activities and causes the person to feel unrested or sleepy during the day. Short-term insomnia may be caused by stress or changes in one's schedule or environment. It can last for a few days or weeks. Chronic insomnia occurs three or more nights a week, lasts more than three months, and cannot be fully explained by another health problem or a medication. Chronic insomnia raises the risk of high blood pressure, coronary heart disease, diabetes, and cancer.³⁰

Symptoms of insomnia include the following:

- Lying awake for a long time before falling asleep. This is more common in younger adults.
- Sleeping for only short periods due to waking up often during the night or being awake for most of the night. This is the most common symptom and typically affects older adults.
- Waking up too early in the morning and not being able to get back to sleep.
- Having poor-quality of sleep that causes one to wake up feeling unrested. The person often feels sleepy during the day and has difficulty focusing on tasks. Insomnia can also cause irritability, anxiousness, and depression.³¹

30. National Heart, Lung, and Blood Institute. (2022). *Insomnia*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/insomnia>

See Figure 12.7³² for an illustration of insomnia.



Figure 12.7 Insomnia

To diagnose insomnia, the health care provider asks about a person's sleep habits and may request the person to keep a sleep diary for one to two weeks. A **sleep diary** records the time a person goes to sleep, wakes up, and takes

31. National Heart, Lung, and Blood Institute. (2022). *Insomnia*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/insomnia>

32. "Depiction of a person suffering from Insomnia (sleeplessness).png" by <https://www.myupchar.com/en> is licensed under [CC BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/)

naps each day. Timing of activities such as exercising and drinking caffeine or alcohol are also recorded, as well as feelings of sleepiness throughout the day.³³ A **sleep study** is a diagnostic test that monitors and records data during a client's full night of sleep. It may be ordered to test for other sleep problems, such as circadian rhythm disorders, sleep apnea, and narcolepsy.

TREATMENT

Lifestyle changes often help improve short-term insomnia. The client should be educated about healthy sleep habits, such as the following:

- Make your bedroom sleep friendly. Sleep in a cool, quiet place. Avoid artificial light from the TV or electronic devices, as this can disrupt your sleep-wake cycle.
- Go to sleep and wake up around the same times each day, even on the weekends. If you can, avoid night shifts, irregular schedules, or other things that may disrupt your sleep schedule.
- Avoid caffeine, nicotine, and alcohol before bedtime. Although alcohol can make it easier to fall asleep, it triggers sleep that tends to be lighter than normal. This makes it more likely that you will wake up during the night. The effect of caffeine can last as long as eight hours.
- Get regular physical activity during the daytime (at least five to six hours before going to bed). Exercising close to bedtime can make it harder to fall asleep.
- Avoid daytime naps, especially in the afternoon. This may help you sleep longer at night.
- Eat meals on a regular schedule and avoid late-night dinners to maintain a regular sleep-wake cycle.
- Limit how much fluid you drink close to bedtime. This may help you sleep

33. National Heart, Lung, and Blood Institute. (2022). *Insomnia*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/insomnia>

longer without having to use the bathroom.

- Learn new ways to manage stress. Follow a routine that helps you wind down and relax before bed. For example, read a book, listen to soothing music, or take a hot bath. Your doctor may also recommend massage therapy, meditation, or yoga to help you relax. Acupuncture may also help improve insomnia, especially in older adults.
- Avoid certain over-the-counter and prescription medicines that can disrupt sleep (for example, some cold and allergy medicines).³⁴

A type of counseling called cognitive behavioral therapy for insomnia is usually the first treatment recommended for chronic insomnia. Several prescription medications may also be prescribed to treat insomnia. Some are meant for short-term use while others are meant for long-term use. Some insomnia medications can be habit-forming, and they all can cause dizziness, drowsiness, or worsening of depression or suicidal thoughts.³⁵ Common medications prescribed to treat insomnia are as follows:

- Benzodiazepines, such as lorazepam can be habit-forming and should be taken for only a few weeks. They can interfere with REM sleep.
- Benzodiazepine-receptor agonists, such as zolpidem. Side effects may include anxiety. Rare side effects may include a severe allergic reaction or unintentionally doing activities while asleep such as walking, eating, or driving.
- Melatonin-receptor agonists, such as ramelteon. Rare side effects may include doing activities while asleep, such as walking, eating, or driving, or a severe allergic reaction.

34. National Heart, Lung, and Blood Institute. (2022). *Insomnia*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/insomnia>

35. National Heart, Lung, and Blood Institute. (2022). *Insomnia*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/insomnia>

- Orexin-receptor antagonists, such as suvorexant. This medicine is not recommended for people who have narcolepsy. Rare side effects may include doing activities while asleep, such as walking, eating, or driving, or not being able to move or speak for several minutes while going to sleep or waking up.³⁶

Some clients use over-the-counter (OTC) products as sleep aids. Many contain antihistamines that cause sleepiness. However, they can be unsafe for some people and may not be the best treatment for insomnia. Melatonin supplements are lab-made versions of the sleep hormone melatonin. Many people take melatonin supplements to improve their sleep. However, research has not proven that melatonin is an effective treatment for insomnia. Side effects of melatonin may include daytime sleepiness, headaches, upset stomach, and worsening depression. It can also affect the body's control of blood pressure, causing high or low blood pressure.³⁷

Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) is a common sleep condition that occurs when the upper airway becomes repeatedly blocked during sleep, reducing or completely stopping airflow. If the brain does not send the signals needed to breathe, the condition may be called central sleep apnea.³⁸

36. National Heart, Lung, and Blood Institute. (2022). *Insomnia*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/insomnia>

37. National Heart, Lung, and Blood Institute. (2022). *Insomnia*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/insomnia>

38. National Heart, Lung, and Blood Institute. (2022). *Sleep apnea*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-apnea>

Obstructive sleep apnea can be caused by a person's physical structure or other medical conditions. Risk factors include obesity (causing fat deposits in the neck), large tonsils (that narrow the airway), thyroid disorders, neuromuscular disorders, heart or kidney failure (causing fluid buildup in the neck that narrows the airway), genetic syndromes (such as cleft lip or Down's syndrome), and premature birth (before 37 weeks' gestation).³⁹

Common signs and symptoms of obstructive sleep apnea include the following:

- Reduced or absent breathing, known as apnea events
- Frequent loud snoring
- Gasping for air during sleep
- Excessive daytime sleepiness and fatigue
- Decreases in attention, vigilance, concentration, motor skills, and verbal and visuospatial memory
- Dry mouth or headaches when waking
- Sexual dysfunction or decreased libido
- Waking up often during the night to urinate⁴⁰

Obstructive sleep apnea is diagnosed by a health care provider based on the person's medical history, a physical exam, and results from a sleep study. During sleep studies, the number of episodes of slowed or stopped breathing events are recorded, along with documentation of oxygen levels in the blood during these events.⁴¹

39. National Heart, Lung, and Blood Institute. (2022). *Sleep apnea*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-apnea>

40. National Heart, Lung, and Blood Institute. (2022). *Sleep apnea*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-apnea>

41. National Heart, Lung, and Blood Institute. (2022). *Sleep apnea*. U.S.

TREATMENT

A breathing device, such as a CPAP machine, is a common treatment for clients with obstructive sleep apnea. CPAP stands for continuous positive airway pressure therapy. It uses mild air pressure to keep the airways open. See Figure 12.8⁴² for an illustration of a CPAP.

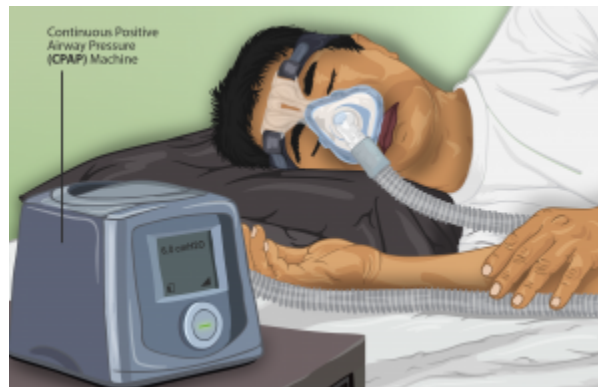


Figure 12.8 CPAP

► Read more about CPAP devices in the “[Oxygen Therapy](#)” chapter in *Open RN Nursing Skills, 2e*.

A mouthpiece may be prescribed for clients with mild obstructive sleep apnea or if the apnea occurs only when lying on their back. Mouthpieces, or oral appliances, are custom-fit devices that are worn while sleeping. See Figure 12.9⁴³ for examples of mouthpieces used to treat sleep apnea.

Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-apnea>

42. “[Depiction of a Sleep Apnea patient using a CPAP machine.png](#)” by <https://www.myupchar.com/en> is licensed under [CC BY-SA 4.0](#)

43. “[Orthoapnea , oral appliance.jpg](#)” by Orthoapnea is licensed under [CC BY-SA](#)

Mouthpieces are custom-fit by a dentist or an orthodontist to the client's mouth and jaw. There are two types of mouthpieces that work differently to open the upper airway. Mandibular repositioning mouthpieces are devices that cover the upper and lower teeth and hold the jaw in a position that prevents it from blocking the upper airway. Tongue-retaining devices are mouthpieces that hold the tongue in a forward position to prevent it from blocking the upper airway.⁴⁴



Figure 12.9 Mouthpieces Used to Treat Sleep Apnea

Narcolepsy

Narcolepsy is an uncommon sleep disorder that causes periods of extreme daytime sleepiness and sudden, brief episodes of deep sleep during the day. Signs and symptoms of narcolepsy include extreme daytime sleepiness; falling asleep without warning, called sleep attacks; difficulty focusing or staying awake; and waking frequently at night. Individuals may experience hallucinations while falling asleep or waking up or sleep paralysis, a feeling of being awake but being unable to move for several minutes. Narcolepsy is diagnosed based on medical history, family history, a physical exam, and a

[3.0](#) and "[3D_printed_mouthpeace.jpg](#)" by unknown author is licensed under [CC BY 3.0](#)

44. National Heart, Lung, and Blood Institute. (2022). *Sleep apnea*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-apnea>

sleep study. The sleep study looks at daytime naps to identify disturbed sleep or a quick onset of rapid eye movement (REM) sleep. Treatment for narcolepsy combines medications and behavior changes. Medications used to treat narcolepsy include stimulants such as modafinil, CNS depressants such as sodium oxybate, and sedatives to improve nighttime sleep. Daytime sleepiness is often improved by promoting good quality sleep at night with scheduled naps during the day.⁴⁵

45. National Heart, Lung, and Blood Institute. (2022). *Narcolepsy*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/narcolepsy>

12.3 Applying the Nursing Process

OPEN RESOURCES FOR NURSING (OPEN RN)

Since the days of Florence Nightingale, sleep has been recognized as beneficial to health and of great importance during nursing care due to its restorative function. It is common for sleep disturbances and changes in sleep pattern to occur in connection with hospitalization, especially among surgical clients. Clients in medical and surgical units often report disrupted sleep, not feeling refreshed by sleep, wakeful periods during the night, and increased sleepiness during the day. Illness and the stress of being hospitalized are causative factors, but other reasons for insufficient sleep in hospitals may be due to an uncomfortable bed, being too warm or too cold, environmental noise such as IV pump alarms, disturbance from health care personnel and other clients, and pain. The presence of intravenous catheters, a urinary catheter, and drainage tubes can also impair sleep. Increased daytime sleepiness, a consequence of poor-quality sleep at night, can cause decreased mobility and slower recovery from surgery. Research indicates that postoperative sleep disturbances can last for months. Therefore, it is important to provide effective nursing interventions to promote sleep.¹

Assessment

Begin a focused assessment on a client's sleep patterns by asking an open-

1. Hellström, A., Fagerström, C., & Willman, A. (2011). Promoting sleep by nursing interventions in health care settings: A systematic review. *Worldviews on Evidence-Based Nursing*, 8(3), 128–142. <https://doi.org/10.1111/j.1741-6787.2010.00203.x>

ended question such as, “Do you feel rested upon awakening?” From there, five key sleep characteristics should be assessed: sleep duration, sleep quality, sleep timing, daytime alertness, and the presence of a sleep disorder. Examples of focused interview questions are included in Table 12.3a. These questions have been selected from sleep health questionnaires from the National Sleep Foundation’s Sleep Health Index and the National Healthy Sleep Awareness Project.²

Table 12.3a Focused Interview Questions Regarding Sleep³

Questions	Normal Findings
How many hours do you sleep on an average night?	7-8 hours for adults (See Table 12.3b for recommended sleep by age range.)
During the past month, how would you rate your sleep quality overall?	Very good or fairly good
Do you go to bed and wake up at the same time every day, even on weekends?	Yes, they generally maintain a consistent sleep schedule
How likely is it for you to fall asleep during the daytime without intending to? Do you struggle to stay awake while you are doing things?	Unlikely
How often do you have trouble going to sleep or staying asleep?	Never, rarely, or sometimes
During the past two weeks, how many times did you have loud snoring while sleeping? Note: It is helpful to ask the client’s sleep partner this question.	Never

2. Chaput, J., & Shiao, J. (2019). Routinely assessing patients’ sleep health is time well spent. *Preventive Medicine Reports*, 14. <https://doi.org/10.1016/j.pmedr.2019.100851>

3. Chaput, J., & Shiao, J. (2019). Routinely assessing patients’ sleep health is time well spent. *Preventive Medicine Reports*, 14. <https://doi.org/10.1016/j.pmedr.2019.100851>

It is also helpful to determine the effects of caffeine intake and medications on a client's sleep pattern. If a client provides information causing a concern for impaired sleep patterns or a sleep disorder, it is helpful to encourage them to create a sleep diary to share with a health care provider. Use the following information to view a sample sleep diary.

▶ Download a [Sleep Diary](#) from the National Heart, Lung, and Blood Institute.

Additional subjective assessment questions can be used to gather information about a client's typical sleep routine so that it can be mirrored during inpatient care, when feasible.

Nurses also perform objective assessments of a client's sleep patterns during inpatient care. The number of hours slept, wakefulness during the night, and episodes of loud snoring or apnea should be documented. Note physical (e.g., sleep apnea, pain, and urinary frequency) or psychological (e.g., fear or anxiety) circumstances that interrupt sleep, as well as sleepiness and napping during the day.^{4,5}

Concerns about signs of sleep disorders should be communicated to the health care provider for follow-up.

Life Span Considerations

The amount of sleep needed changes over the course of a person's lifetime.

4. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.
5. Ackley, B., Ladwig, G., Makic, M. B., Martinez-Kratz, M., & Zanotti, M. (2020). *Nursing diagnosis handbook: An evidence-based guide to planning care* (12th ed.). Elsevier. pp. 843-846.

Although sleep needs vary from person to person, Table 12.3b shows general recommendations for different age groups based on recommendations from the American Academy of Sleep Medicine (AASM) and the American Academy of Pediatrics (AAP).⁶

Table 12.3b Recommended Amounts of Sleep by Age Group⁷

Age	Recommended Amount of Sleep
Infants aged 4-12 months	12-16 hours a day (including naps)
Children aged 1-2 years	11-14 hours a day (including naps)
Children aged 3-5 years	10-13 hours a day (including naps)
Children aged 6-12 years	9-12 hours a day
Teens aged 13-18 years	8-10 hours a day
Adults aged 18 years or older	7-8 hours a day

If an older adult has Alzheimer’s disease, it often changes their sleeping habits. Some people with Alzheimer’s disease sleep too much; others don’t sleep enough. Some people wake up many times during the night; others wander or yell at night. The person with Alzheimer’s disease isn’t the only one who loses sleep. Caregivers may have sleepless nights, leaving them tired for the challenges they face. Educate caregivers about these steps to promote safety for their loved one and help them and the client sleep better at night:

- Make sure the floor is clear of objects.
- Lock up any medications.

6. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

7. National Heart, Lung, and Blood Institute. (2022). *Sleep deprivation and deficiency*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/sleep-deprivation-and-deficiency>

- Attach grab bars in the bathroom.
- Place a gate across the stairs.⁸

DIAGNOSTIC TESTS

A sleep study may be ordered for a client suspected of having a sleep disorder. A sleep study monitors and records data during a client's full night of sleep. A sleep study may be performed at a sleep center or at home with a portable diagnostic device. If done at a sleep center, the client will sleep in a bed at the sleep center for the duration of the study. Removable sensors are placed on the person's scalp, face, eyelids, chest, limbs, and a finger to record brain waves, heart rate, breathing effort and rate, oxygen levels, and muscle movements before, during, and after sleep. There is a small risk of irritation from the sensors, but this will resolve after they are removed.⁹ See Figure 12.10¹⁰ of an image of a client with sensors in place for a sleep study.

8. National Institute on Aging. (2016). *A good night's sleep*. U.S. Department of Health & Human Services. <https://www.nia.nih.gov/health/good-nights-sleep#safe>
9. National Heart, Lung, and Blood Institute. (2022). *Insomnia*. U.S. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/insomnia>
10. "Wired up for a sleep study_02A.jpg" by Joe Mabel is licensed under [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/)



Figure 12.10 Sleep Study

DIAGNOSES

NANDA-I nursing diagnoses related to sleep include *Disturbed Sleep Pattern, Insomnia, Readiness for Enhanced Sleep, and Sleep Deprivation*.¹¹ When creating a nursing care plan for a client, review a nursing care planning source for current NANDA-I approved nursing diagnoses and interventions related to sleep. See Table 12.3c for the definition and selected defining characteristics of *Sleep Deprivation*.

Table 12.3c Sample NANDA-I Nursing Diagnosis Related to Sleep Deprivation¹²

11. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.
12. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.

NANDA-I Diagnosis	Definition	Selected Defining Characteristics
Sleep Deprivation	Prolonged periods of time without sustained natural, periodic suspension of relative consciousness that provides rest.	Anxiety Apathy Combativeness Confusion Decreased functional ability Prolonged reaction time Drowsiness Fatigue Hallucinations Heightened sensitivity to pain Irritable mood Transient paranoia

A sample nursing diagnostic statement is, *“Sleep Deprivation related to an overstimulating environment as evidenced by irritability, difficulty concentrating, and drowsiness.”*

Outcome Identification

An overall goal related to sleep is, *“The client will awaken refreshed once adequate time is spent sleeping.”*¹³

A sample SMART outcome is, *“The client will identify preferred actions to ensure adequate sleep by discharge.”*¹⁴

13. Ackley, B., Ladwig, G., Makic, M. B., Martinez-Kratz, M., & Zanotti, M. (2020). *Nursing diagnosis handbook: An evidence-based guide to planning care* (12th ed.). Elsevier. pp. 843-846.

14. Ackley, B., Ladwig, G., Makic, M. B., Martinez-Kratz, M., & Zanotti, M. (2020). *Nursing diagnosis handbook: An evidence-based guide to planning care* (12th ed.). Elsevier. pp. 843-846.

Planning Interventions

Evidence-based nursing interventions to enhance sleep are summarized in the following box.

Sleep Enhancement Interventions^{15,16}

- Adjust the environment (e.g., light, noise, temperature, mattress, and bed) to promote sleep
- Encourage the client to establish a bedtime routine to facilitate wakefulness to sleep
- Facilitate maintenance of the client's usual bedtime routines during inpatient care
- Encourage elimination of stressful situations before bedtime
- Instruct the client to avoid bedtime foods and beverages that interfere with sleep
- Encourage limitation of electronic devices before bedtime (e.g., phone, computer, television)
- Encourage the client to limit daytime sleep and participate in activity, as appropriate
- Bundle care activities to minimize the number of awakenings by staff to allow for sleep cycles of at least 90 minutes

15. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.

16. Ackley, B., Ladwig, G., Makic, M. B., Martinez-Kratz, M., & Zanotti, M. (2020). *Nursing diagnosis handbook: An evidence-based guide to planning care* (12th ed.). Elsevier. pp. 843-846.

- Consider sleep apnea as a possible cause and notify the provider for a possible referral for a sleep study when daytime drowsiness occurs despite adequate periods of undisturbed night sleep
- Educate the client regarding sleep-enhancing techniques

Transforming Hospitals Into Restful Environments to Promote Healing

Nurses nationwide have been researching innovative ways to transform hospitals into more restful environments that promote healing. As reported in the *American Nurse*, strategies include using red lights at night to reduce light exposure, reducing environmental noise, bundling care, offering sleep aids, and providing client education¹⁷ :

- **Switching to Red Lights:** Nurses can use red lights when providing care at night. Adult and pediatric clients were found to sleep better with reduced white lights.
- **Reduce Environmental Noise:** Clients were surveyed regarding factors that affected their ability to sleep, and results indicated bed noises, alarms, squeaking equipment, and sounds from other clients. Noise can be reduced by replacing the wheels on the trash cans and squeaky wheels

17. Trossman, S. (2018). Nurses offer strategies to promote patients' rest and sleep. *American Nurse*. <https://www.myamericannurse.com/strategies-promote-patients-rest-sleep/>

on chairs, repairing malfunctioning motors on beds, switching automatic paper towel machines in the hallways with manual ones, and altering the times floors are buffed. Visitor rules can be implemented, such as no overnight stays in semiprivate rooms and overnight visitors in private rooms were asked to not use their cell phones, turn on the TV, or use bright lights at night.

- **Bundling Care:** Nurses reinforce bundling care by interdisciplinary team members to reduce sleep interruptions. For example, a “Quiet Time” policy can be set from midnight to 5 a.m. Quiet Time includes dimming lights, closing client room doors, and talking in lower voices.
- **Offering Sleep Aids:** Nurses can ask clients about what aids they use at home to help them sleep, such as extra pillows or listening to music. On admission, sleep kits can be provided with ear plugs and eye masks and at bedtime, warm washcloths can be offered to clients for comfort.
- **Client Education:** Clients and families can be provided with printed materials on the benefits of sleep and rest for optimal healing, participating in rehabilitative therapies, and prevention of delirium.

Pharmacological Interventions

See specific information about medications used to facilitate sleep in the previous “[Sleep Disorders](#)” section of this chapter.

Implementing Interventions

When implementing interventions to promote sleep, it is important to customize them according to the specific client’s needs and concerns. If

medications are administered to promote sleep, fall precautions should be implemented, and the nurse should monitor for potential side effects, such as dizziness, drowsiness, worsening of depression or suicidal thoughts, or unintentionally walking or eating while asleep.

Evaluation

When evaluating the effectiveness of interventions, start by asking the client how rested they feel upon awakening. Determine the effectiveness of interventions based on the established SMART outcomes customized for each client situation.

12.4 Putting It All Together

Client Scenario

Mrs. Salvo is a 65-year-old woman admitted to the hospital for a gastrointestinal (GI) bleed. She has been hospitalized for three days on the medical-surgical floor. During this time, she has received four units of PRBCs, has undergone a colonoscopy and an upper GI series, and had hemoglobin levels drawn every four hours. The nurse reports to the client's room to conduct an assessment prior to beginning the 11 p.m.-7 a.m. shift.

Although Mrs. Salvo's hemoglobin has stabilized for the last 24 hours, Mrs. Salvo appears fatigued with bags under her eyes. In conversation with her, she yawns frequently and wanders off in her train of thought. She reports, "You can't get any rest in here. I am poked and prodded at least once an hour."

Applying the Nursing Process

Assessment: The nurse notes that Mrs. Salvo has bags under her eyes, is yawning frequently, reports difficulty achieving rest, and seems to have difficulty following the conversation.

Based on the assessment information that has been gathered, the following nursing care plan is created for Mrs. Salvo:

Nursing Diagnosis: *Disturbed Sleep Pattern related to interruptions for therapeutic monitoring as evidenced by reports of difficulty achieving rest, bags under eyes, frequent yawning, and difficulty following conversation.*

Overall Goal: *The client will demonstrate improvement in sleeping pattern.*

SMART Expected Outcome: *Mrs. Salvo will report feeling more rested on awakening within 24 hours.*

Planning and Implementing Nursing Interventions:

The nurse will assess the client's sleep pattern and therapeutic monitoring disturbances. The nurse will group lab draws, vital signs, assessments, and other care tasks to decrease sleep disruption. The nurse will ensure the

client's door is closed and lighting is turned down to create a restful environment. The nurse will complete as many tasks as possible when Mrs. Salvo is awake and advocate with the interprofessional team for uninterrupted periods of rest during the night.

Sample Documentation:

Mrs. Salvo has a disturbed sleep pattern due to frequent therapeutic monitoring. Mrs. Salvo reports difficulty achieving rest, and despite stabilization in hemoglobin level, continues to demonstrate signs of fatigue. Interventions have been implemented to group therapeutic care to minimize disruption to the client's sleep.

Evaluation:

The following morning, Mrs. Salvo reports improved sleep and feeling more rested with fewer awakenings throughout the night. SMART outcome "met."

12.5 Learning Activities

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Activities

(Answers to “Learning Activities” can be found in the “Answer Key” at the end of the book. Answers to interactive activity elements will be provided within the element as immediate feedback.)

Scenario A

A nurse is caring for a client who has been hospitalized after undergoing hip-replacement surgery. The client complains of not sleeping well and feels very drowsy during the day.

1. What factors are affecting the client’s sleep pattern?
2. What assessments should the nurse perform?
3. What SMART outcome can be established for this client?
4. Outline interventions the nurse can implement to enhance sleep for this client.
5. How will the nurse evaluate if the interventions are effective?

Scenario B

A nurse is assigned to work rotating shifts and develops difficulty sleeping.

1. Why do rotating shifts affect a person’s sleep pattern?

2. What are the symptoms of insomnia?
3. Describe healthy sleep habits the nurse can adopt for more restful sleep.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=1895#h5p-68>



- ▶ Test your knowledge using this [NCLEX Next Generation-style bowtie question](#). You may reset and resubmit your answers to this question an unlimited number of times.¹

1. “[Chapter 12 Assignment 1](#)” by Tami Davis for [OpenRN](#) is licensed under [CC BY-NC 4.0](#)

XII Glossary

OPEN RESOURCES FOR NURSING (OPEN RN)

Circadian rhythms: Body rhythms that direct a wide variety of functions, including wakefulness, body temperature, metabolism, and the release of hormones. They control the timing of sleep, causing individuals to feel sleepy at night and creating a tendency to wake in the morning without an alarm. ([Chapter 12.2](#))

Insomnia: A common sleep disorder that causes trouble falling asleep, staying asleep, or getting good quality sleep. Insomnia interferes with daily activities and causes the person to feel unrested or sleepy during the day. Short-term insomnia may be caused by stress or changes in one's schedule or environment, lasting a few days or weeks. Chronic insomnia occurs three or more nights a week, lasts more than three months, and cannot be fully explained by another health problem or a medicine. Chronic insomnia raises the risk of high blood pressure, coronary heart disease, diabetes, and cancer. ([Chapter 12.2](#))

Microsleep: Brief moments of sleep that occur when a person is awake. A person can't control microsleep and might not be aware of it. ([Chapter 12.2](#))

Narcolepsy: An uncommon sleep disorder that causes periods of extreme daytime sleepiness and sudden, brief episodes of deep sleep during the day. ([Chapter 12.2](#))

Non-REM sleep: Slow-wave sleep when restoration takes place and the body's temperature, heart rate, and oxygen consumption decrease. ([Chapter 12.2](#))

Obstructive sleep apnea (OSA): A common sleep condition that occurs when the upper airway becomes repeatedly blocked during sleep, reducing or completely stopping airflow. If the brain does not send the signals needed to breathe, the condition may be called central sleep apnea. ([Chapter 12.2](#))

REM sleep: Rapid eye movement (REM) sleep when heart rate and respiratory rate increase, eyes twitch, and brain activity increases. Dreaming

occurs during REM sleep, and muscles become limp to prevent acting out one's dreams. ([Chapter 12.2](#))

Sleep diary: A record of the time a person goes to sleep, wakes up, and takes naps each day for 1-2 weeks. Timing of activities such as exercising and drinking caffeine or alcohol are also recorded, as well as feelings of sleepiness throughout the day. ([Chapter 12.2](#))

Sleep study: A diagnostic test that monitors and records data during a client's full night of sleep. A sleep study may be performed at a sleep center or at home with a portable diagnostic device. ([Chapter 12.2](#))

Sleep-wake homeostasis: The homeostatic sleep drive keeps track of the need for sleep, reminds the body to sleep after a certain time, and regulates sleep intensity. This sleep drive gets stronger every hour a person is awake and causes individuals to sleep longer and more deeply after a period of sleep deprivation. ([Chapter 12.2](#))

PART XIII
MOBILITY

13.1 Mobility Introduction

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Objectives

- Identify factors putting clients at risk for mobility problems
- Identify cues related to mobility problems
- Identify the effects of immobility on body systems
- Describe nursing interventions to prevent complications of immobility
- Contribute to a plan of care for clients with mobility alterations

Sit on a sturdy chair with your legs and arms stretched out in front of you, and then try to stand. This basic mobility task can be impaired during recovery from major surgery or for clients with chronic musculoskeletal conditions. Mobility, which includes moving one's extremities, changing positions, sitting, standing, and walking, helps avoid degradation of many body systems and prevents complications associated with immobility. Nurses assist clients to be as mobile as possible, based on their individual circumstances, to achieve their highest level of independence, prevent complications, and promote a feeling of well-being. This chapter will discuss nursing assessments and interventions related to promoting mobility.

13.2 Basic Concepts

OPEN RESOURCES FOR NURSING (OPEN RN)

Musculoskeletal Anatomy, Physiology, and Assessment

Before discussing the concept of mobility, it is important to understand the anatomy of the musculoskeletal system, common musculoskeletal conditions, and the components of a musculoskeletal system assessment. Read more about these topics in the “[Musculoskeletal Assessment](#)” chapter in *Open RN Nursing Skills, 2e*.

Mobility and Immobility

Mobility is the ability of a client 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.¹ Mobility exists on a continuum, ranging from no impairment (i.e., the client can make major and frequent changes in position without assistance) to being completely immobile (i.e., the client is unable to make even slight changes in body or extremity position without assistance). See Figure 13.1² for an image of a client with impaired physical mobility requiring assistance with a wheelchair.

1. Skalsky, A. J., & McDonald, C. M. (2012). Prevention and management of limb contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675–687. <https://doi.org/10.1016/j.pmr.2012.06.009>
2. “[hospice-1821429_960_720.jpg](#)” by [truthseeker08](#) is licensed under [CC0](#)



Figure 13.1 Impaired Physical Mobility

Functional mobility is the ability of a person to move around in their environment, including walking, standing up from a chair, sitting down from standing, and moving around in bed. The three main areas of functional mobility are the following:

- **Bed Mobility:** The ability of a client to move around in bed, including moving from lying to sitting and sitting to lying.
- **Transferring:** The action of a client moving from one surface to another. This includes moving from a bed into a chair or moving from one chair to another.
- **Ambulation:** The ability to walk. This includes walking independently but with assistance from another person or an assistive device, such as a cane, walker, or crutches.

Immobility can be caused by several physical and psychological factors, including acute and chronic diseases, traumatic injuries, and chronic pain. Several neurological and musculoskeletal disorders can adversely affect mobility, including osteoarthritis, rheumatoid arthritis, muscular dystrophy, cerebral palsy, multiple sclerosis, and Parkinson's disease. Traumatic injuries, such as skeletal fractures, head injuries, or spinal injuries, also impair mobility. Diseases that cause fatigue, such as heart failure, chronic obstructive

pulmonary disease, and depression, or conditions that cause pain also affect the client's desire or ability to move.

Effects of Immobility

Clients who spend an extended period of time in bed as they recover from surgery, injury, or illness can develop a variety of complications due to loss of muscle strength (estimated at a rate of 20% per week of immobility).

Regardless of the cause, immobility can cause degradation of cardiovascular, respiratory, gastrointestinal, and musculoskeletal functioning. Promoting mobility can prevent these complications from occurring. Findings from a literature review demonstrated several benefits of mobilization, including less delirium, pain, urinary discomfort, urinary tract infection, fatigue, deep vein thrombosis (DVT), and pneumonia, as well as an improved ability to void.

Mobilization also decreased depression, anxiety, and symptom distress, while enhancing comfort, satisfaction, quality of life, and independence.³ See Table 13.2a for a summary of the effects of immobility on these body systems.^{4,5,6}

3. Kalisch, B., Lee, S., & Dabney, B. (2013). Outcomes of inpatient mobilisation: A literature review. *Journal of Clinical Nursing*, 23(11-12), 1486-1501. <https://doi.org/10.1111/jocn.12315>
4. Javed, M. J. (2023). *Assisting patients with mobility*. StatPearls [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK559100/>
5. American Nurses Association. (2014). Current topics in safe patient handling and mobility. *American Nurse Today* (supplement). https://www.myamericannurse.com/wp-content/uploads/2014/07/ant9-Patient-Handling-Supplement-821a_LOW.pdf
6. Skalsky, A. J., & McDonald, C. M. (2012). Prevention and management of limb contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675–687. <https://doi.org/10.1016/j.pmr.2012.06.009>

Decreased mobility is also a major risk factor for skin breakdown, as indicated on the Braden Scale. See Figure 13.2⁷ for an image of a client with impaired mobility who developed a DVT.



Figure 13.2 Deep Vein Thrombosis (DVT)

Table 13.2a Effects of Immobility on Body Systems⁸

7. "[Deep vein thrombosis of the right leg.jpg](#)" by [James Heilman, MD](#) is licensed under [CC BY-SA 3.0](#)

8. Skalsky, A. J., & McDonald, C. M. (2012). Prevention and management of limb contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675–687. <https://doi.org/10.1016/j.pmr.2012.06.009>

Body System	Immobility Effects	Potential Complications
Psychological	Depression Anxiety Distress	Decreased quality of life
Cardiovascular	Decreased systemic vascular resistance causing venous pooling in extremities Decreased cardiac output	Orthostatic hypotension Thrombus formation
Respiratory	Decreased strength of respiratory muscles Diminished lung expansion Hypoventilation Impaired gas exchange Decreased cough reflex Pulmonary secretion pooling Blood redistribution and fluid shifts within the lung tissues	Atelectasis Hypoxia Pneumonia Pulmonary edema Pulmonary embolism
Integumentary	Decreased delivery of oxygen and nutrients to tissues Tissue ischemia Inflammation over bony prominences Friction and shear	Skin breakdown Pressure injuries Infection Abrasions

Musculoskeletal	<p>Reduced muscle mass</p> <p>Decreased muscle strength</p> <p>Decreased endurance</p> <p>Shortening of connective tissue</p> <p>Impaired joint mobility</p> <p>Impaired calcium metabolism</p>	<p>Fatigue</p> <p>Decreased stability and balance</p> <p>Muscle atrophy</p> <p>Joint contractures</p> <p>Foot drop</p> <p>Osteoporosis</p> <p>Falls</p> <p>Fractures</p>
Gastrointestinal	<p>Decreased peristalsis</p> <p>Anorexia</p> <p>Decreased fluid intake</p> <p>Increased intestinal gas</p> <p>Altered swallowing</p>	<p>Constipation</p> <p>Fecal impaction</p> <p>Ileus</p> <p>Flatulence</p> <p>Abdominal distention</p> <p>Nausea and vomiting</p> <p>Heartburn</p> <p>Aspiration</p> <p>Malnutrition</p>
Genitourinary	<p>Urinary discomfort</p> <p>Urinary retention</p>	<p>Urinary tract infection</p>

Read additional information pertaining to the content in Table 13.2a using the information in the following box.

- ▶ Read additional details about assessing the cardiovascular system and assessing for deep vein thrombosis (DVT) in the “[Cardiovascular Assessment](#)” chapter in *Open RN Nursing Skills, 2e*.
- ▶ Read additional details about performing a “[Respiratory Assessment](#)” in *Open RN Nursing Skills, 2e*.

- ▶ Read more about treating hypoxia in the “[Oxygenation](#)” chapter of this textbook.
- ▶ Read about preventing pressure injuries in the “[Integumentary](#)” chapter of this textbook.
- ▶ Read details about performing a “[Musculoskeletal Assessment](#)” in *Open RN Nursing Skills, 2e*.
- ▶ Read more about constipation, impaction, ileus, urinary retention, and urinary tract infection in the “[Elimination](#)” chapter of this textbook.
- ▶ Review how to perform an “[Abdominal Assessment](#)” in *Open RN Nursing Skills, 2e*.

Strategies to promote client mobility can be divided into two categories: those used when the client is in bed and those used when the client is able to get out of bed. In-bed interventions to enhance mobility include performing repositioning activities, completing range-of-motion exercises, and assisting the client to dangle on the edge of a bed. Out-of-bed interventions to enhance mobility include transferring the client from bed to chair and assisting with ambulation.⁹ Unfortunately, ambulation of clients has been identified as the most frequently missed element of inpatient nursing care with rates as high as 76–88% of the time.¹⁰ Before discussing these

9. American Nurses Association. (2014). Current topics in safe patient handling and mobility. *American Nurse Today* (supplement). https://www.myamericannurse.com/wp-content/uploads/2014/07/ant9-Patient-Handling-Supplement-821a_LOW.pdf
10. Kalisch, B., Lee, S., & Dabney, B. (2013). Outcomes of inpatient mobilisation: A literature review. *Journal of Clinical Nursing* 23(11-12), 1486-1501. <https://doi.org/10.1111/jocn.12315>

interventions to promote mobility, let's review the assessments that a nurse must perform prior to safely implementing mobilization interventions.

Assessing Mobility Status and the Need for Assistance

A client'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 on admission to a facility by a physical therapist (PT). See Table 13.2b for an example of common types of assistance required.

Table 13.2b Common Types of Assistance Required¹¹

Type of Assistance Required	Description
Dependent	The client is unable to help at all. A mechanical lift and assistance by other personnel are required to perform tasks.
Maximum Assistance	The client can perform 25% of the mobility task while the caregiver assists with 75%.
Moderate Assistance	The client can perform 50% of the mobility task while the caregiver assists with 50%.
Minimal Assistance	The client can perform 75% of the mobility task while the caregiver assists with 25%.
Contact Guard Assist	The caregiver places one or two hands on the client's body to help with balance but provides no other assistance to perform the functional mobility task.
Stand By Assist	The caregiver does not touch the client or provide assistance but remains close to the client for safety in case they lose their balance or need help to maintain safety during the task being performed.
Independent	The client can safely perform the functional task on their own without assistance.

11. Miller, B. (n.d.). *Functional mobility and physical therapy*. Capital Area Physical Therapy and Wellness. <https://www.capitalareapt.com/functional-mobility-and-physical-therapy/>

In addition to the amount of assistance required, health care providers or physical therapists may determine a client's weight-bearing status. For example, clients with lower extremity fractures or those recovering from knee or hip replacement often progress through stages of weight-bearing activity. See Table 13.2c for common weight-bearing prescriptions.

Table 13.2c Weight-Bearing Prescriptions

Type of Weight-Bearing	Description
Nonweight-bearing (NWB)	The leg must not touch the floor and is not permitted to support any weight at all. Crutches or other devices are used for mobility.
Toe-touch weight-bearing (TTWB)	The foot or toes may touch the floor to maintain balance, but no weight should be placed on the affected leg.
Partial weight-bearing	A small amount of weight may be supported on the affected leg. Weight may be gradually increased to 50% of body weight, which permits the person to stand with body weight evenly supported by both feet (but not walking).
Weight-bearing as tolerated	The client can support 50% to 100% of weight on the affected leg and can independently choose the weight supported by the extremity based on their tolerance and the circumstances.
Full weight-bearing	The leg can support 100% of a person's body weight, which permits walking.

In addition to reviewing orders regarding weight-bearing and assistance required, all staff should assess client mobility before and during interventions, such as transferring from surface to surface or during ambulation. Staff may frequently rely on the client's or a family member's report on the client's ability to stand, transfer, and ambulate, but this information can be unreliable. For example, the client may have unrecognized physical deconditioning from the disease or injury that necessitated hospitalization, or they may have developed new cognitive impairments related to the admitting diagnosis or their current medications.¹²

12. American Nurses Association. (2014). Current topics in safe patient handling

Several objective screening tests, such as the Timed Get Up and Go Test, have traditionally been used by nurses to assess a client's mobility status. The **Timed Get Up and Go Test** begins by having the client stand up from an armchair, walk three yards, turn around, walk back to the chair, and sit down. As the client performs these maneuvers, their posture, body alignment, balance, and gait are analyzed. However, this test and other tests do not provide guidance on what the nurse should do if the client can't maintain seated balance, bear weight, or stand and walk. The Banner Mobility Assessment Tool (BMAT) was developed to provide guidance regarding safe client handling and mobility (SPHM). It is used as a nurse-driven bedside assessment of client mobility and walks the client through a four-step functional task list and identifies the mobility level the client can achieve. It then provides guidance regarding the SPHM technology needed to safely lift, transfer, and mobilize the client.¹³ Read additional information about the Banner Mobility Assessment Tool (BMAT) in the following box.

▶ View the [Banner Mobility Assessment Tool for Nurses](#).¹⁴

and mobility. *American Nurse Today* (supplement).

https://www.myamericannurse.com/wp-content/uploads/2014/07/ant9-Patient-Handling-Supplement-821a_LOW.pdf

13. American Nurses Association. (2014). Current topics in safe patient handling and mobility. *American Nurse Today* (supplement).

https://www.myamericannurse.com/wp-content/uploads/2014/07/ant9-Patient-Handling-Supplement-821a_LOW.pdf

14. Boynton, T., Kelly, L., Perez, A., Miller, M., An, Y., & Trudgen, C. (2014). Banner mobility assessment tool for nurses: Instrument validation.

American Journal of Safe Patient Handling & Movement, 4(3).

<https://www.safety.duke.edu/sites/default/files/BMAT%20for%20Nurses.pdf>

See the following box for an example of a nurse using the BMAT.

Example of Banner Mobility Assessment Tool In Action¹⁵

A 65-year-old male was admitted to the hospital late in the evening. He was 6'2" tall and weighed 350 lbs. (158 kg). He needed to have a bowel movement but stated he didn't want to use a bedpan. The nurse wasn't comfortable getting him up to use the bathroom because he hadn't yet been evaluated by physical therapy, and a physical therapist wasn't available until the following morning. Per agency policy, the nurse assessed the client using the BMAT and found he was able to raise his buttocks off the bed using a bed rail and hold for a count of five. but stated he used a walker at home to ambulate. He was rated at Mobility Level 3, and the nurse transferred him to the toilet using a nonpowered stand aid. Both the client and nurse were relieved and satisfied with the outcome.

Safe Client Handling

Assisting clients with decreased immobility poses an increased risk of injury to health care workers. A focus on safe client handling and mobility in acute and long-term care settings over the past decade has resulted in decreased staff lifting injuries for the first time in 30 years. Nonetheless, nurses still suffer more musculoskeletal disorders from lifting than other employees in the manufacturing and construction industries. Many employers and nurses

15. American Nurses Association. (2014). Current topics in safe patient handling and mobility. *American Nurse Today* (supplement). https://www.myamericannurse.com/wp-content/uploads/2014/07/ant9-Patient-Handling-Supplement-821a_LOW.pdf

previously believed that lifting injuries could be prevented by using proper body mechanics, but evidence contradicts this assumption. **Body mechanics** involves the coordinated effort of muscles, bones, and one's nervous system to maintain balance, posture, and alignment when moving, transferring, and positioning clients.¹⁶ The National Institute of Occupational Safety and Health (NIOSH) calculates maximum loads for lifting, pushing, pulling, and carrying for all types of employees. For example, a maximum load for employees lifting a box with handles is 50 pounds (23 kg), but this weight is decreased when the lifter has to reach, lift from near the floor, or assume a twisted or awkward position. Because clients don't come in simple shapes and may sit or lie in awkward positions, move unexpectedly, or have wounds or devices that interfere with lifting, the safe lifting load for clients is less than this maximum 50-pound load. Although using proper body mechanics and good lifting techniques are important, they don't prevent lifting injuries in these client circumstances^{17 18 19}. Factors that increase risk for lifting injuries in nurses are exertion, frequency, posture, and duration of exposure. Combinations of these factors, such as high exertion while in an awkward posture (for example,

16. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
17. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
18. American Nurses Association. (2014). Current topics in safe patient handling and mobility. *American Nurse Today* (supplement). https://www.myamericannurse.com/wp-content/uploads/2014/07/ant9-Patient-Handling-Supplement-821a_LOW.pdf
19. National Institute for Occupational Safety and Health. (2013, August 2). *Safe patient handling and mobility (SPHM)*. Centers for Disease Control and Prevention. <https://www.cdc.gov/niosh/topics/safepatient/default.html>

holding a client's leg while bent over and twisted), unpredictable client movements, and extended reaching, intensify the risk.²⁰

In 2013 the American Nurses Association (ANA) published Safe Patient Handling and Mobility (SPHM) standards. See the standards in the box below. See other information about safe client handling in the following box.

- ▶ View ANA videos on safe client handling: [Preventing Nurse Injuries](#) and [ANA Presents Safe Patient Handling and Mobility](#).
- ▶ Read an ANA article on [Safe Patient Handling – The Journey Continues](#).

ANA Standards for Safe Patient Handling and Mobility²¹

Standard 1: Establish a culture of safety. This standard calls for the employer to establish a commitment to a culture of safety. This means prioritizing safety over competing goals in a blame-free environment where individuals can report errors or incidents without fear. The employer is compelled to evaluate

20. Francis, R., & Dawson, M. (2016). Safe patient handling and mobility: The journey continues. *American Nurse Today*, 11(5).
<https://www.myamericannurse.com/wp-content/uploads/2016/05/Patient-Handling-Safety-426b.pdf>

21. American Nurses Association. (2014). Current topics in safe patient handling and mobility. *American Nurse Today* (supplement).
https://www.myamericannurse.com/wp-content/uploads/2014/07/ant9-Patient-Handling-Supplement-821a_LOW.pdf

systemic issues that contribute to incidents or accidents. The standard also calls for safe staffing levels and improved communication and collaboration. Every organization should have a procedure for nurses to report safety concerns or refuse an assignment due to concern about patients' or their own safety.

Standard 2: Implement and sustain an SPHM program. This standard outlines SPHM program components, including patient assessment and written guidelines for safe patient handling by staff.

Standard 3: Incorporate ergonomic design principles to provide a safe care environment. This standard is based on the concept of prevention of injuries through ergonomic design that considers the physical layout, work-process flow, and use of technology to reduce exposure to injury or illness.

Standard 4: Select, install, and maintain SPHM technology. This standard provides guidance in selecting, installing, and maintaining SPHM technology.

Standard 5: Establish a system for education, training, and maintaining competence. This standard outlines SPHM training for employees, including the demonstration of competency before using SPHM technology with patients.

Standard 6: Integrate patient-centered SPHM assessment, plan of care, and use of SPHM technology. This standard focuses on the patient's needs by establishing assessment guidelines and developing an individual plan of care. It outlines the importance of using SPHM technology in a therapeutic manner with the goal of promoting patients' independence. For example, a patient may need full-body lift technology immediately after surgery, then progress to a sit-to-stand lift for

transfers, and then progress to a technology that supports ambulation.

Standard 7: Include SPHM in reasonable accommodation and post-injury return to work. This standard promotes an employee's return to work after an injury.

Standard 8: Establish a comprehensive evaluation system. The final standard calls for evaluation of outcomes related to an agency's implementation of a SPHM program with remediation of deficiencies.

Assistive Devices

There are several types of assistive devices that a nurse may incorporate during safe client handling and mobility. An **assistive device** is an object or piece of equipment designed to help a client with activities of daily living, such as a walker, cane, gait belt, or mechanical lift.²² Assistive devices include other items described below.

Gait Belts

Gait belts should be used to ensure stability when assisting clients to stand, ambulate, or transfer from bed to chair. A gait belt is a 2-inch-wide (5 mm) belt, with or without handles, that is placed around a client's waist and

22. Agency for Healthcare Research and Quality. (2019). *Never events*. Patient Safety Network. <https://psnet.ahrq.gov/primer/never-events>

fastened with a buckle. The gait belt should be applied on top of clothing or a gown to protect the client's skin. See Figure 13.3²³ for an image of a gait belt.



Figure 13.3 Gait Belt

Slider Boards

A **slider board** (also called a transfer board) is used to transfer an immobile client from one surface to another while the client is lying supine (e.g., from a stretcher to hospital bed).²⁴ See Figure 13.4²⁵ for an image of a client being transferred by logrolling off a slider board with several assistants.

23. "GaitBelt.jpg" by unknown author is licensed under [CC BY 4.0](#). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-2-body-mechanics/>

24. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

25. "SliderBoard2-1.jpg" by unknown author is licensed under [CC BY 4.0](#). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-7-transfers-and-ambulation/>



Figure 13.4 Slider Board

Sit to Stand Lifts

Sit to stand lifts (also referred to as Sara lifts, lift ups, stand assist, or stand-up lifts) are mobility devices that assist weight-bearing clients who are unable to transition from a sitting position to a standing position using their own strength. They are used to safely transfer clients who have some muscular strength but not enough strength to safely change positions by themselves. Some sit to stand lifts use a mechanized lift whereas others are nonmechanized. See Figure 13.5²⁶ for an image of a nurse assisting a client to stand with a sit to stand lift.

26. “invacare-reliant-350-electric-sit-to-stand-lift-3.jpg” by [Invacare](#). This image is included on the basis of Fair Use.



Figure 13.5 Sit to Stand Lift

Mechanical Lifts

A **mechanical lift** is a hydraulic lift with a sling used to move clients who cannot bear weight or have a medical condition that does not allow them to stand or assist with moving. It can be a portable device or permanently attached to the ceiling. See Figure 13.6²⁷ for an image of a mechanical lift.



Most clinical agencies do not allow nursing students to operate mechanical lifts independently without the supervision of agency staff. Review agency policy and obtain assistance as indicated, even if you have experience using mechanical lifts as an employee at another agency.

²⁷. “molift_air_200_rgosling_mb_env_585707.jpg” by unknown author, courtesy of [etac](#). This image is included on the basis of Fair Use.



Figure 13.6 Mechanical Lift

Early Mobility Protocols

Many hospitals use nurse-driven mobility protocols to encourage early mobility of clients in intensive care units and after surgery. The purpose of early mobility protocols is to maintain the client's baseline mobility and functional capacity, decrease the incidence of delirium, and decrease hospital length of stay. Protocols include a coordinated approach by the multidisciplinary team and may include respiratory therapists, physical therapists, pharmacists, occupational therapists, and the health care provider who focus on getting the client out of bed faster.²⁸

When early mobility protocols are in place, nurses use a screening tool to determine whether a client is clinically ready to attempt the protocol. This

28. Agency for Healthcare Research and Quality. (2017). *Nurse-driven early mobility protocols: Facilitator guide*. <https://www.ahrq.gov/hai/tools/mvp/modules/technical/nurse-early-mobility-protocols-fac-guide.html>

algorithm begins by reviewing the client's neurological criteria, such as, does the client open his or her eyes in response to verbal stimulation? If the client meets neurological criteria, they are assessed against additional criteria for respiratory, circulatory, neurological, and other considerations. If the client meets these criteria, a registered nurse may carefully initiate an early mobilization protocol in collaboration with a physical therapist. See Figure 13.7²⁹ for an example of an early mobilization protocol used for clients in an ICU.³⁰

29. U.S. Department of Health & Human Services. (n.d.). *Nurse-driven early mobility protocols: Facilitator Guide | Agency for Healthcare Research and Quality*. Agency for Healthcare Research and Quality. <https://www.ahrq.gov/hai/tools/mvp/modules/technical/nurse-early-mobility-protocols-fac-guide.html>
30. Agency for Healthcare Research and Quality. (2017). *Nurse-driven early mobility protocols: Facilitator guide*. <https://www.ahrq.gov/hai/tools/mvp/modules/technical/nurse-early-mobility-protocols-fac-guide.html>

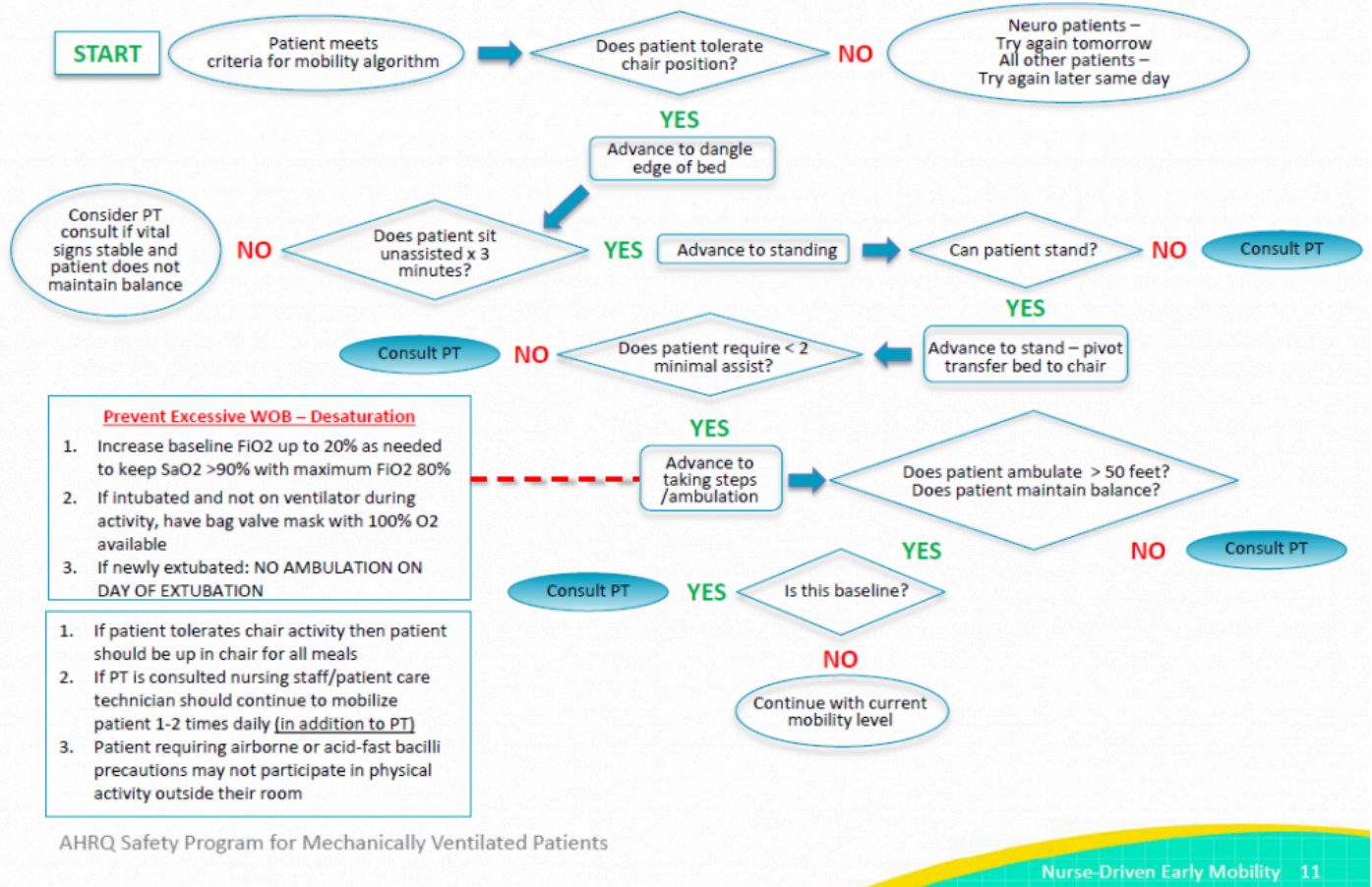


Figure 13.7 Early Mobilization Protocol for ICU Clients

See the following box for an example of a mobilization protocol in an intermediate care unit.

Example of Early Mobilization Protocol³¹

31. Agency for Healthcare Research and Quality. (2017). *Nurse-driven early mobility protocols: Facilitator guide*. <https://www.ahrq.gov/hai/tools/mvp/modules/technical/nurse-early-mobility-protocols-fac-guide.html>

Here is an example of using an early mobilization protocol in an intermediate care unit with patient care technicians (PCT). Three PCTs collaborate with nurses from 7 a.m. to 7 p.m. Each PCT has eight clients and is responsible for mobilizing client during each 12-hour shift. Each patient care technician discusses each client's level of activity with the RN at the beginning of the shift and determines how many times each client will be mobilized throughout the day. Any concerns that arise during mobilization are shared with the nurse for appropriate follow-up.

Range-of-Motion Exercises

When clients are unable to ambulate or have an injury to specific extremities, **range-of-motion (ROM) exercises** are often prescribed. ROM exercises facilitate movement of specific joints and promote mobility of the extremities. Because changes in joints can occur after three days of immobility, ROM exercises should be started as soon as possible. There are three types of ROM exercises: passive, active, and active assist. **Passive range of motion** is movement applied to a joint 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. For example, clients who undergo knee replacement surgery may be prescribed a passive motion machine that continuously flexes and extends the client's knee while lying in bed. See Figure 13.8³² for an image of a passive motion machine. **Active range of motion** is movement of a joint by the individual performing the exercise with no outside force aiding in the movement. **Active assist range of motion** is joint movement with partial assistance from an outside force. For example,

32. "[Continuous Passive Motion Machine.jpg](#)" by [User:Ravedave](#) is licensed under [CC BY-SA 3.0](#)

during the recovery period after shoulder surgery, a client attends physical therapy and receives 50% assistance in moving the arm with the help of a physical therapy assistant.



Figure 13.8 Passive Motion Machine

- ▶ View an [infographic](#) demonstrating range-of-motion exercises.

Clients may receive temporary ROM exercises due to injury, surgery, or other temporary conditions. These clients are expected to make a full recovery and over time will no longer need ROM to ensure the proper functioning of their joint. Other clients require long-term ROM exercises to prevent contractures that can occur in conditions such as spinal cord injury, stroke, neuromuscular diseases, or traumatic brain injury. A **contracture** is the lack of full passive range of motion due to joint, muscle, or soft tissue limitations.³³ See Figure

33. Skalsky, A. J., & McDonald, C. M. (2012). Prevention management of limb contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675-687. <https://dx.doi.org/10.1016%2Fj.pmr.2012.06.009>

13.9³⁴ for an image of a severe leg contracture in a client with a terminal neurological condition.



Figure 13.9 Contracture

Range-of-motion exercises are prescribed by a physical therapist and can be performed by physical therapy assistants (PTAs), nursing assistants (NAs), patient care technicians (PCTs), and nurses based on agency policy.

Guidelines for performing range-of-motion exercises include the following:

- A program of passive stretching should be started as early as possible in the course of neuromuscular disease to prevent contractures and become part of a regular morning and evening routine.
- Proper technique is essential for passive stretching to be effective. With each stretch, the position should be held for a count of 15, and each exercise should be repeated 10 to 15 times during a session (or as prescribed). Stretching should be performed slowly and gently. An overly

34. "[Muscle contractures of young man.jpg](#)" by Maria Sieglinda von Nudeldorf is licensed under [CC BY-SA 4.0](#)

strenuous stretch may cause discomfort and reduce cooperation.

- Written instructional materials should be provided to the client and family as a supplement to verbal instructions and demonstrations by the physical therapist.



Watch a YouTube video demonstration of [passive motion exercises](#).³⁵

Limb positioning with assistive devices can also be used to prevent contracture formation. The limb should be placed in a resting position that opposes or minimizes flexion.³⁶ Positioning aids include pillows, foot boots, handrolls, hand-wrist splints, heel or elbow protectors, abduction pillows, or a trapeze bar. See Figure 13.10³⁷ for an image of a brace used to prevent foot drop in a client with multiple sclerosis. Foot drop is a complication of immobility that results in plantar flexion of the foot, interfering with the ability to complete weight-bearing activities.

35. Mayo Clinic. (2020, March 30). *Passive motion exercises*. [Video]. YouTube. All rights reserved. https://youtu.be/EjJ5nX_jM-w

36. Skalsky, A. J., & McDonald, C. M. (2012). Prevention management of limb contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675-687. <https://dx.doi.org/10.1016%2Fj.pmr.2012.06.009>

37. "[AFO_Ankle_Foot_Orthosis_Orthotic_Brace.JPG](#)" by Pagemaker787 is licensed under [CC BY-SA 4.0](#)



Figure 13.10 Brace to Prevent Foot Drop

Read additional information about range-of-motion exercises, preventing contractures, and physical therapy in the following box.

- ▶ Review how to perform [Active Range-of-Motion Exercises](#).
- ▶ Read how to [Prevent and Manage Contractures](#).
- ▶ Read more details about [Physical Therapy](#).

Repositioning Clients

Repositioning a bedridden client maintains body alignment and prevents pressure injuries, foot drop, and contractures. Proper positioning also provides comfort for clients who have decreased mobility related to a medical condition or treatment. When repositioning a client in bed, supportive devices such as pillows, rolls, and blankets can aid in providing comfort and

safety. There are several potential positions that are determined based on the client's medical condition, preferences, or treatment related to an illness.³⁸ It is important to reposition clients appropriately to prevent neurological injuries that can occur, such as if a client is inadvertently positioned on their arm.

Supine Position

In **supine positioning**, the client lies flat on their back. Pillows or other devices may be used to prevent foot drop. Additional supportive devices, such as pillows under the arms, may be added for comfort. See Figure 13.11³⁹ for an image of a client in the supine position.⁴⁰



Figure 13.11 Supine Position

38. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
39. "supine.jpg" by unknown author is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-4-positioning-a-patient-in-bed/>
40. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

Prone Position

In **prone positioning**, the client lies on their stomach with their head turned to the side.⁴¹ Pillows may be placed under the lower legs to align the feet. See Figure 13.12⁴² for an image of a client in the prone position. Placing clients in the prone position may improve their oxygenation status in certain types of medical disorders, such as COVID-19.⁴³



Figure 13.12 Prone Position

41. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
42. “prone.jpg” by unknown author is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-4-positioning-a-patient-in-bed/>
43. Shelhamer, M., Wesson, P., Solari, I. L., Jensen, D. L., Steele, W. A., Dimitrov, V. G., Kelly, J. D., Aziz, S., Gutierrez, V. P., Vittinghoff, E., Chung, K. K., Menon, V. P., Ambris, H. A., & Baxi, S. M. (2021). Prone positioning in moderate to severe acute respiratory distress syndrome due to COVID-19: A cohort study and analysis of physiology. *Journal of Intensive Care Medicine*, 36(2), 241-252. <https://doi.org/10.1177%2F0885066620980399>

Lateral Position

In **lateral positioning**, the client lies on one side of their body with the top leg flexed over the bottom leg. This position helps relieve pressure on the coccyx.⁴⁴ A pillow may be placed under the top arm for comfort. See Figure 13.13⁴⁵ for an image of a client in the lateral position. The lateral position is often used for pregnant women to prevent inferior vena cava compression and enhance blood flow to the fetus.



Figure 13.13 Lateral Position

Sim's Position

In **Sim's positioning**, the client is positioned halfway between the supine and prone positions with their legs flexed. A pillow is placed under the top leg. Their arms should be comfortably placed beside them, not underneath.⁴⁶ See

44. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

45. "lateral.jpg" by unknown author is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-4-positioning-a-patient-in-bed/>

46. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient*

Figure 13.14⁴⁷ for an image of a client in Sim's position. The Sim's position is used during some procedures, such as the administration of an enema.



Figure 13.14 Sim's Position

Fowler's Position

In **Fowler's positioning**, the head of bed is placed at a 45- to 90-degree angle. The bed can be positioned to slightly flex the hips to help prevent the client from migrating downwards in bed.⁴⁸ See Figure 13.15⁴⁹ for an image of a client in Fowler's position. High Fowler's position refers to the bed being at a

Care. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

47. "sims.jpg" by unknown author is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-4-positioning-a-patient-in-bed/>

48. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

49. "degreeLow.jpg" by unknown author is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-4-positioning-a-patient-in-bed/>

90-degree angle. The Fowler's position is used to promote lung expansion and improve a client's oxygenation. It is also used to prevent aspiration in clients while eating or receiving tube feeding.



Figure 13.15 Fowler's Position

Semi-Fowler's Position

In **Semi-Fowler's positioning**, the head of bed is placed at a 30- to 45-degree angle. The client's hips may or may not be flexed. See Figure 13.16⁵⁰ for an image of a client in Semi-Fowler's position. Semi-Fowler's position is used for the same purposes as Fowler's position but is generally better tolerated over long periods of time because there is less pressure on the coccyx area than with Fowler's and High-Fowler's position.

50. "degreeSemi.jpg" by unknown author is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-4-positioning-a-patient-in-bed/>



Figure 13.16 Semi-Fowler's Position

Trendelenburg Position

In **Trendelenburg positioning**, the head of the bed is placed lower than the client's feet. This position may be used in certain situations to promote venous return to the head and heart, such as during severe hypotension and medical emergencies.⁵¹ See Figure 13.17⁵² for an image of Trendelenburg position.

51. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
52. "Sept-22-2015-097.jpg" by unknown author is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-4-positioning-a-patient-in-bed/>



Figure 13.17 Trendelenburg Position

Tripod Position

Clients who are feeling short of breath often naturally assume the tripod position. In the **tripod position**, the client leans forward while sitting with their elbows on their knees or resting on a table. Clients experiencing breathing difficulties can be placed in this position to enhance lung expansion and air exchange. See Figure 13.18⁵³ for images of an individual demonstrating breathing difficulty who has assumed the tripod position.

53. "Tripod_position.png" by Nic Ashman, [Chippewa Valley Technical College](#) is licensed under [CC BY 4.0](#)



Figure 13.18 Tripod Position

Moving a Client Up in Bed

When moving a client up in bed, first determine the level of assistance needed to provide optimal client care. It is vital to prevent friction and shear when moving a client up in bed to prevent pressure injuries. If a client is unable to assist with repositioning in bed, follow agency policy regarding using lifting devices and mechanical lifts. If the client is able to assist with repositioning and minimal lifting by staff is required, use the following guidelines with assistance from another health care professional to help with

the move and prevent injury.⁵⁴ See Figure 13.19⁵⁵ for an image of moving a client up in bed.



Figure 13.19 Moving a Client Up in Bed

When moving a client up in bed, nurses generally follow these steps⁵⁶:

- Explain to the client what will happen and how the client can help.
- Raise the bed to a safe working height and ensure that the brakes are applied.
- Position the client in the supine position with the bed flat. Place a pillow

54. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

55. "Book-pictures-2015-572.jpg" by unknown author is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-5-positioning-a-patient-on-the-side-of-a-bed/>

56. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus Pressbooks. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

at the head of the bed and against the headboard to prevent accidentally bumping the client's head on the headboard.

- Two health care professionals should stand with feet shoulder width apart between the shoulders and hips of the client at the bedside. This keeps the heaviest part of the client closest to the center of gravity of the health care providers. Weight will be shifted from back foot to front foot.
- Fan-fold the draw sheet toward the client with palms facing up. This provides a strong grip to move the client up with the draw sheet.
- Ask the client to tilt their head toward their chest, fold arms across their chest, and bend their knees to assist with the movement. Let the client know when the move will happen. This step prevents injury from occurring to the client and prepares them for the move.
- Tighten your gluteal and abdominal muscles, bend your knees, and keep your back straight and neutral. Face the direction of movement. Proper body mechanics can help prevent back injury when used in appropriate client care situations.
- On the count of three by the lead person, gently slide (not lift) the client up the bed, shifting your weight from the back foot to the front, keeping your back straight and knees slightly bent.
- Replace the pillow under the client's head, reposition the client in the bed, and cover them with a sheet or blanket to provide comfort.
- Lower the bed, raise the side rails as indicated, and ensure the call light is within reach. Perform hand hygiene.

Assisting Clients to Seated Position

Prior to ambulating, repositioning, or transferring a client from one surface to another (e.g., a bed to a wheelchair), it is often necessary to move the client to the side of the bed to avoid straining or excessive reaching by the health care professional. Positioning the client to the side of the bed also allows the health care provider to have the client as close as possible to their center of gravity for optimal balance during client handling.⁵⁷

57. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient*

Clients who have been lying in bed may experience **vertigo**, a sensation of dizziness as if the room is spinning, or orthostatic hypotension, low blood pressure that occurs when a client changes position from lying to sitting or sitting to standing and causes the client to feel dizzy, faint, or light-headed. **Orthostatic hypotension** is defined as a drop in systolic blood pressure of 20 mm Hg or more or a drop of diastolic blood pressure of 10 mm Hg or more within three minutes of sitting or standing. For this reason, always begin a transfer or ambulation process by sitting the client on the side of the bed for a few minutes with their legs dangling.⁵⁸

Begin by explaining to the client what will happen and how they can help. Determine if additional assistance or a mechanical lift is needed.⁵⁹ See Figure 13.20⁶⁰ for images of a nurse assisting a client to a seated position.

Care. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

58. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
59. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>
60. “Book-pictures-2015-5851.jpg,” “Book-pictures-2015-587.jpg,” and “Book-pictures-2015-588.jpg” by unknown authors are licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-5-positioning-a-patient-on-the-side-of-a-bed/>



Figure 13.20 Assisting a Client to a Seated Position

When moving a client to a seated position, nurses generally follow these steps⁶¹ :

- Ensure the bed is in a low and locked position.
- Stand facing the head of the bed at a 45-degree angle with your feet apart, with one foot in front of the other. Stand next to the waist of the client.
- Ask the client to turn onto their side, facing you, as they move closer to the edge of the bed.
- Place one hand behind the client's shoulders, supporting the neck and vertebrae.
- On the count of three, instruct the client to use their elbows to push up against the bed and then grasp the side rail as you support their shoulders as they sit. Shift your weight from the front foot to the back

⁶¹. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

foot as you assist them to sit. Do not allow the client to place their arms around your shoulders because this can lead to serious back or neck injuries.

- As you shift your weight, gently grasp the client's outer thighs with your other hand and help them slide their feet off the bed to dangle or touch the floor. This step helps the client sit and move their legs off the bed at the same time. As you perform this action, bend your knees and keep your back straight and neutral.
- Assess the client for symptoms of orthostatic hypotension or vertigo. If they are experiencing any dizziness, request them to sit and dangle on the edge of the bed and determine if the symptoms resolve before transferring or ambulating.

Ambulating a Client

Ambulation is the ability of a client to safely walk independently, with assistance from another person, or with an assistive device, such as a cane, walker, or crutches. After a client has been assessed and determined safe to ambulate, determine if assistive devices or the assistance of a second staff member is required. Apply a gait belt snugly over their clothing and around their waist per agency policy if assistance is required. See Figure 13.21⁶² for an image of applying a gait belt. The client should be cooperative, able to bear weight on their own, have good trunk control, and be able to transition to a standing position on their own. If these criteria are not met, then mechanical devices, such as a sit to stand lift, should be used to assist a weight-bearing client from a sitting position to a standing position. If a client uses a walker or cane, these assistive devices should be placed near the bed before beginning this procedure.

62. "Sept-22-2015-119.jpg" and "Sept-22-2015-121-001.jpg" by unknown authors are licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-5-positioning-a-patient-on-the-side-of-a-bed/>



Figure 13.21 Application of a Gait Belt

Nurses generally follow these steps when assisting a seated client to ambulate⁶³ :

- Assist the client to sit on the side of the bed and assess for symptoms of vertigo or orthostatic hypotension before proceeding. Ensure the client is wearing proper footwear, such as shoes or nonslip socks.
- Stand in front of the client, with your legs on the outside of their legs.
- Grasp each side of the gait belt, while keeping your back straight and knees bent, and then rock your weight backwards while gently steadying the client into a standing position.
- After the client is standing and feels stable, move to their unaffected side and grasp the gait belt in the middle of their back. If needed for stability, place one arm under the client's arm, gently grasp their forearm, and lock your arm firmly under the client's axilla. In this position, if the client starts to fall, you can provide support at the client's shoulder.⁶⁴

⁶³. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

⁶⁴. Moroz, A. (2017). *Physical therapy (PT)*. Merck Manual Professional Version.

- If the client uses a walker or cane, ensure the client is using this device before beginning ambulation.
- Before stepping away from the bed, ask the client if they feel dizzy or light-headed. If they do, sit the client back down on the bed until the symptoms resolve. If the client feels stable, begin walking by matching your steps to the client's.
- Instruct the client to look ahead and lift each foot off the ground. Walk only as far as the client can tolerate without feeling dizzy or weak.
- Periodically ask them how they are feeling to check for dizziness or weakness.
- In some situations of early ambulation, it is helpful for a second staff member to follow behind the client with a wheeled walker or wheelchair in case the client needs to sit while walking. See Figure 13.22⁶⁵ for an image of a nurse assisting the client to stand.

<https://www.merckmanuals.com/professional/special-subjects/rehabilitation/physical-therapy-pt>

65. “Sept-22-2015-122-e1443986200821.jpg,” “Sept-22-2015-124.jpg,” and “Sept-22-2015-128.jpg” by unknown authors are licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-5-positioning-a-patient-on-the-side-of-a-bed/>



Figure 13.22 Assisting a Client to Stand

To assist the client back into the bed or a chair, have them stand with the back of their knees touching the bed or chair. Grasp the gait belt and assist them as they lower into a sitting position, keeping your back straight and knees bent. Remove the gait belt. If the client is returning to bed, place the bed in the lowest position, raise the side rails as indicated, and ensure the call light is within reach. Cover the client with a sheet or blanket to provide comfort. Document the distance of ambulation and the client's tolerance of ambulation.

Transfer From Bed to Chair or Wheelchair

Clients often require assistance when moving from a bed to a chair or wheelchair. A client must be cooperative and predictable, able to bear weight on both legs, and able to take small steps and pivot to safely transfer with a one-person assist. If any of these criteria are not met, a two-person transfer, or mechanical lift is recommended. Always complete a mobility assessment and

check the provider's or physical therapist's orders prior to transferring clients.⁶⁶

Nurses generally follow these steps when moving a client from a bed or chair to a wheelchair⁶⁷ :

- Begin by explaining to the client what will happen during the transfer and how they can help. Be sure proper footwear is in place. Lower the bed to a 45-degree angle. Place the wheelchair next to the bed and apply the wheelchair brakes. If the client has weakness on one side, place the wheelchair on their strong side.
- Assist the client to a seated position on the side of the bed with their feet on the floor. (See the previous section on how to assist a client to a seated position.)
- Apply the gait belt snugly around their waist.
- Place your legs on the outside of their legs. Ask them to place their hands on your waist as they raise themselves into a standing position. Do not lift the client. If additional assistance is required, obtain a mechanical lift, such as a sit to stand device. Do not allow them to put their arms around your neck because this can cause neck or back injury.
- Stay close to the client during the transfer to keep the client's weight close to your center of gravity.
- Once standing, ask the client to pivot and then take a few steps back until they can feel the wheelchair on the back of their legs.
- Have the client grasp the arm of the wheelchair and lean forward slightly.
- Assist the client to lower themselves, while shifting your weight from your

66. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

67. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

back leg to the front leg with your knees bent, trunk straight, and elbows slightly bent. Allow the client to slowly lower themselves into the wheelchair using the armrests for support.


See Figure 13.23⁶⁸ for an image of a staff member assisting a client to a wheelchair.

Reflective Question: What could be improved during this transfer?

68. “Book-pictures-2015-603.jpg” and “Book-pictures-2015-6041” by unknown authors are licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-7-transfers-and-ambulation/>



Figure 13.23 Assisting a Client to a Wheelchair

 View a video⁶⁹ on Assisting a Patient from Bed to Chair With a Gait Belt or Transfer Belt.

69. Thompson Rivers University. (n.d.). *Nursing | Assisting from bed to chair with a gait belt or transfer belt* [Video]. All rights reserved.

https://barabus.tru.ca/nursing/assisting_from_bed.html

Lowering A Client to the Floor

A client may begin to fall while ambulating or while being transferred from one surface to another. If a client begins to fall from a standing position, do not attempt to stop the fall or catch the client because this can cause back injury. Instead, try to control their fall by lowering them to the floor.⁷⁰

If a client starts to fall and you are close by, move behind the client and take one step back. Support the client around the waist or hip area or grab the gait belt. Bend one leg and place it between the clients legs. Slowly slide the client down your leg, lowering yourself to the floor at the same time. Always protect their head first. Once the client is on the floor, assess the client for injuries prior to moving them. Assess the client's need for assistance to get off the floor. If the client is unable to get up off the floor, use a mechanical lift. Complete an incident report and follow up according to the client's condition and agency policy. See Figure 13.24⁷¹ for images of lowering a client to the floor.

70. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

71. "Sept-22-2015-132-001.jpg" and "Sept-22-2015-133.jpg" by unknown authors are licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). Access for free at <https://opentextbc.ca/clinicalskills/chapter/3-7-fall-prevention/>



Figure 13.24 Lowering a Client to the Floor

Preventing Falls

Falls are a major safety concern in health care. Nurses are responsible for identifying, managing, and eliminating potential fall hazards for clients. All client-handling activities (positioning, transfers, and ambulation) pose a risk to both clients and health care professionals. Older adults are often at increased risk for falls due to impaired mental status, decreased strength, impaired balance and mobility, and decreased sensory perception. Clients may also be at risk for falls due to gait problems, cognitive ability, visual problems, urinary frequency, generalized weakness, cognitive impairments,

or medications that may cause hypotension or drowsiness.⁷² Falls can cause head injuries, fractures, lacerations, and other injuries.

Fall prevention is key. If a client begins to feel dizzy while ambulating or transferring, assist them to sit on a chair or on the floor to avoid a fall. The head is the most important part of the body, so protect it as much as possible. In the event of a fall, seek help and stay with the client until assistance arrives. Follow agency policy for reporting, assessing, and documenting. After a fall, always assess a client for injuries prior to moving them. If the client remains weak or dizzy, do not attempt to ambulate them, but instead, ask for assistance to transfer them to a chair or bed.⁷³

All clients should be assessed for risk factors for falls and necessary fall precautions implemented per agency policy. Read more information about preventing falls in the “[Safety](#)” chapter.

72. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

73. Doyle, G. R., & McCutcheon, J. A. (2015). *Clinical Procedures for Safer Patient Care*. BC Campus. <https://opentextbc.ca/clinicalskills/front-matter/introduction/>

13.3 Applying the Nursing Process

OPEN RESOURCES FOR NURSING (OPEN RN)

Assessment

Because mobility issues are directly related to musculoskeletal disorders, it is necessary to perform a thorough assessment of the musculoskeletal system and its effect on the client's mobility status. Begin by assessing muscle strength and then coordination, and then assess mobility skills in the following order: mobility in bed, dangling on the bed with supported and then unsupported sitting, weight-bearing while transferring from sitting to standing or to a chair, standing, walking with assistance, and walking independently.

▶ Read more details about performing a "[Musculoskeletal Assessment](#)" in *Open RN Nursing Skills, 2e*.

Because immobility can negatively affect several body systems, perform a thorough head-to-toe assessment for clients with impaired mobility. Assess the cardiovascular system, including blood pressure, heart sounds, apical and peripheral pulses, and capillary refill time. Assess for the presence of edema and for signs of a potential deep vein thrombosis (DVT).

Assess the respiratory system, including respiratory rate, oxygen saturation, lung sounds, chest wall movement and symmetry, and depth and effort of respirations. Assess for potential signs of atelectasis and pneumonia.

Assess the gastrointestinal system by inspecting for distension, auscultating bowel sounds, and palpating the abdomen for tenderness. Ask the client about the date of their last bowel movement, and monitor stool patterns and stool characteristics. If constipation is suspected, palpate the client's left lower quadrant for signs of stool presence. Assess for the presence of urinary tract

abnormalities related to immobility, such as suprapubic distention or tenderness that can result from urinary retention. Monitor 24-hour trend of intake and output, as well as for symptoms of dysuria, urgency, or frequency. Note if urinary incontinence is occurring due to the inability of the client to reach the restroom in time.¹

Life Span Considerations

At each stage of growth and development, the nurse assesses a client's mobility and provides appropriate education. For example, infants move their limbs, hold their head up, roll, sit, crawl, stand, and then eventually walk. Parents are educated about these developmental milestones during well-child visits. When working with school-age children, nurses provide education to prevent injury that can occur with activity, such as using helmets and knee pads to prevent injury while bicycling and skateboarding. As teenagers become adults, the nurse provides education about the effects of alcohol and other drugs on balance and safety while driving. Older adults are at increased risk for immobility. Conditions such as osteoarthritis, orthostatic hypotension, inner ear dysfunction, osteoporosis resulting in hip fractures, stroke, and Parkinson's disease are among the most common causes of immobility in old age.

Hospitalization poses a risk for altered functional status of older adults due to acute illness, decreased mobility, and the negative effects of bedrest. The American Academy of Nursing issued a recommendation in 2014 stating, "Don't let older adults lie in bed or only get up to a chair during their hospital stay." This recommendation highlights the importance of implementing evidence-based measures to promote activity during hospitalization to

1. Skalsky, A. J., & McDonald, C. M. (2012). Prevention and management of limb contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675–687. <https://doi.org/10.1016/j.pmr.2012.06.009>

prevent functional decline in older adults.² Review the potential effects of immobility in Table 13.2a in the “[Basic Concepts](#)” section of this chapter.

▶ View [evidence-based strategies to reduce functional decline](#) in hospitalized older adults provided by The Hartford Institute for Geriatric Nursing.³

Diagnoses

There are several nursing diagnoses related to mobility. Review a nursing care planning source for current NANDA-I approved nursing diagnoses and interventions. A commonly used NANDA-I nursing diagnosis is *Impaired Physical Mobility*.⁴ See Table 13.3 for the definition and selected defining characteristics of this diagnosis.

Table 13.3 NANDA-I Nursing Diagnosis Impaired Physical Mobility⁵

2. American Academy of Nursing’s Expert Panel on Acute and Critical Care. (n.d.). *Reducing functional decline in older adults during hospitalization*. The Hartford Institute for Geriatric Nursing, Rory Meyers College of Nursing, New York University. <https://hign.org/consultgeri/try-this-series/reducing-functional-decline-older-adults-during-hospitalization>
3. The Hartford Institute for Geriatric Nursing, Rory Meyers College of Nursing, New York University. (n.d.). *Assessment tools for best practices of care for older adults*. <https://hign.org/consultgeri-resources/try-this-series>
4. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.
5. Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.). (2021). *Nursing diagnoses: Definitions and classification 2021-2023, Twelfth Edition*. Thieme Publishers New York.

NANDA-I Diagnosis	Definition	Selected Defining Characteristics
Impaired Physical Mobility	Limitation in independent, purposeful movement of the body or of one or more extremities	Altered gait Decreased fine motor skills Decreased gross motor skills Decreased range of motion Prolonged reaction time Difficulty turning Postural instability Uncoordinated or slow movement

A sample nursing diagnosis in PES format is, *“Impaired Physical Mobility related to decrease in muscle strength as evidenced by slow movement and alteration in gait.”*

Outcome Identification

A sample overall goal for a client with *Impaired Physical Mobility* is, *“The client will participate in activities of daily living to the fullest extent possible for their condition.”*

A sample SMART outcome is, *“The client will demonstrate appropriate use of adaptive equipment (e.g., a walker) for safe ambulation by the end of the shift.”*

Planning Interventions

Nursing interventions promote a client’s mobility and prevent effects of immobility. To avoid or minimize complications of immobility, mobilize the client as soon as possible and to the fullest extent possible. Mobilization efforts, ranging from dangling on the edge of the bed, sitting up in a chair, and assisting with early ambulation, depend on the client’s unique circumstances, such as their medical condition and surgery performed. For example, a client undergoing a cardiac catheterization may be mobilized

within a few hours following the procedure, whereas a client undergoing total knee arthroplasty may begin mobilizing 24 hours following the surgery.⁶ See details about early mobilization protocols earlier in this chapter.

Encourage the client to perform activities of daily living (ADLs) as independently as possible and participate in prescribed physical therapy. Encourage or perform active or passive range-of-motion exercises as prescribed by the physical therapist. Be aware that pain and fear of falling can be major deterrents to a client's willingness to ambulate or perform physical therapy. Monitor the client's level of pain by using a valid pain intensity rating scale. Administer medications for anticipated pain prior to physical therapy sessions, and consider nonpharmacologic measures such as repositioning, splinting, and heat/cold application to reduce musculoskeletal discomfort. Encourage rest between activities. Educate the client about appropriately using assistive devices and other fall precautions.^{7,8}

For clients at risk for developing pneumonia due to immobility, encourage adequate fluid intake to liquefy pulmonary secretions, and teach deep breathing and coughing exercises to prevent atelectasis. Monitor oxygenation levels and provide supplemental oxygen as prescribed to maintain adequate oxygenation, especially during ambulation.⁹

6. Skalsky, A. J., & McDonald, C. M. (2012). Prevention and management of limb contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675–687. <https://doi.org/10.1016/j.pmr.2012.06.009>
7. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.
8. Skalsky, A. J., & McDonald, C. M. (2012). Prevention and management of limb contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675–687. <https://doi.org/10.1016/j.pmr.2012.06.009>
9. Skalsky, A. J., & McDonald, C. M. (2012). Prevention and management of limb

For bed-bound clients, elevate the head of the bed to 30 to 45 degrees to promote lung expansion, unless medically contraindicated, and turn and reposition the client every two hours. Perform hourly rounding to check on the client's needs and to prevent falls. Protect the skin as needed to minimize the potential for breakdown, and advocate for devices to prevent contractures, as needed.^{10,11}

Implementing Interventions

When implementing interventions to promote mobility, in addition to reviewing the current orders regarding assistance and weight-bearing, assess the client's current status. For example, use the Banner Mobility Assessment Tool to determine the client's current mobility status and needs for safe client handling.

Monitor for signs of vertigo and orthostatic hypotension and assist the client to a sitting or lying position if they occur. Monitor vital signs before, during, and after physical activity and institute appropriate fall prevention strategies as indicated. Orthostatic hypotension is defined as a drop in systolic blood pressure of 20 mmHg or more or in diastolic blood pressure of 10 mm Hg or more after three minutes of standing. If orthostatic hypotension is suspected, measure the client's vital signs while they are supine, sitting, and standing before encouraging ambulation. Monitor and document the client's

contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675–687. <https://doi.org/10.1016/j.pmr.2012.06.009>

10. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). Nursing interventions classification (NIC) (8th ed.). Elsevier.
11. Skalsky, A. J., & McDonald, C. M. (2012). Prevention and management of limb contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675–687. <https://doi.org/10.1016/j.pmr.2012.06.009>

response to activity, such as heart rate, blood pressure, dyspnea, and skin color.^{12,13}

- ▶ Read additional information about [Orthostatic Vital Sign Measurements](#) to prevent falls by the Agency for Healthcare Research and Quality.

Evaluation

Determine the client's progress towards their specific SMART outcomes. Encourage their participation in the setting of realistic goals for mobility and modify these goals as needed for safety.

12. Wagner, C. M., Butcher, H. K., & Clarke, M. F. (2024). *Nursing interventions classification (NIC)* (8th ed.). Elsevier.
13. Skalsky, A. J., & McDonald, C. M. (2012). Prevention and management of limb contractures in neuromuscular diseases. *Physical Medicine and Rehabilitation Clinics of North America*, 23(3), 675–687. <https://doi.org/10.1016/j.pmr.2012.06.009>

13.4 Putting It All Together

Client Scenario

Mrs. Howard is a 73-year-old woman who was recently admitted to the medical-surgical floor with pneumonia. She has an underlying history of emphysema and has experienced a recent exacerbation of dyspnea during activity. This morning when being assisted to the bathroom, she reports, “I have to stop and catch my breath when walking.” Vital signs this morning indicated oxygen saturation 91% and respiratory rate 18 on room air at rest. During report it was communicated that Mrs. Howard is able to ambulate with the assistance of one but only moves short distances around the room before she needs to stop and rest.

Applying the Nursing Process

Assessment: The nurse identifies a relevant cue that the client, diagnosed with pneumonia and a previous history of emphysema, is experiencing increased dyspnea when walking around the room that requires her to stop and rest. The nurse gathers additional assessment data while the client is walking and discovers her respiratory rate increases to 30 and her oxygen saturation level decreases to 85% after walking for two minutes. Additionally, the client stops and catches her breath after walking approximately 10 feet, causing her to limit her mobility.

The nurse reviews the client’s chart and finds an order for “Oxygen via nasal cannula up to 5 L/min PRN to maintain oxygen saturation at 90%.” The nurse also notes a referral for physical therapy evaluation and strengthening exercises.

Based on the assessment information gathered, the following nursing care plan is created for Mrs. Howard:

Nursing Diagnosis: *Impaired Physical Mobility r/t activity intolerance as manifested by client unable to ambulate more than ten feet without*

respiratory symptoms and client report of “I have to stop and catch my breath while walking.”

Overall Goal: *The client will demonstrate improvement in mobility.*

SMART Expected Outcomes:

- *Mrs. Howard will ambulate 50 feet in the hallway within 24 hours.*
- *Mrs. Howard will maintain an oxygen saturation level of 90% or higher while ambulating within 24 hours.*

Planning and Implementing Nursing Interventions:

The nurse plans to administer oxygen to the client via nasal cannula as needed to maintain an oxygen saturation level of 90% or higher. The nurse will teach the client about the importance of balancing periods of activity with periods of rest and reinforce the use of pursed-lip breathing. The nurse will encourage client ambulation and her active participation in completing ADLs. The nurse will collaborate with physical therapy to educate the client regarding strengthening exercises and reinforce principles of progressive exercise. The nurse plans to further assess the client’s smoking history and promote smoking cessation.

Sample Documentation:

At 0800 when assisting the client to the bathroom, the client reported, “I have to stop and catch my breath when walking.” At 0830, vital signs were reassessed while the client was walking. Her respiratory rate increased to 30 and her oxygen saturation level decreased to 85% after 2 minutes of walking. The client stopped to catch her breath after walking approximately 10 feet. Oxygen via nasal cannula at 1 L/min was applied to the client before ambulating in the hallway at 1000. The client’s oxygen saturation level dropped to 88% after one minute of walking and the oxygen was increased to 2 L/min. The client’s oxygen saturation then remained at 90% for the remainder of the walk, and she was able to ambulate 50 feet. Pursed-lip breathing was demonstrated and reinforced during the walk. Physical therapy was contacted, and an evaluation scheduled for later this morning. The client reports a smoking history of a pack per day for 50 years and states she is interested in stopping smoking. A smoking cessation brochure was provided and discussed. Dr. Smith was notified of these events at 1030.

Evaluation:

Within 24 hours, Mrs. Howard successfully ambulated 50 feet in the hallway while maintaining oxygen saturation level of 90%. SMART outcomes were “met.” Planned interventions will continue. SMART outcome is revised to, “*Mrs. Howard will ambulate 100 feet in the hallway within 24 hours.*”

13.5 Learning Activities

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Activities

(Answers to “Learning Activities” can be found in the “Answer Key” at the end of the book. Answers to interactive activity elements will be provided within the element as immediate feedback.)

Ms. Curtis is a 67-year-old client admitted for a left total knee replacement. She is post-op Day 2 and is currently receiving care on the medical-surgical unit. Ms. Curtis has been complaining of pain and refused her previous two physical therapy appointments. She agrees to sitting up in the chair but declines walking.

1. What focused assessments should the nurse perform and why?
2. What complications could occur related to Ms. Curtis' immobility?
3. What SMART outcomes should the nurse plan in collaboration with Ms. Curtis?
4. List interventions the nurse should plan for Ms. Curtis and their rationale.
5. How will the nurse evaluate if the interventions are successful?



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<https://wtcs.pressbooks.pub/nursingfundamentals/?p=2040#h5p-69>



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=2040#h5p-45>



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=2040#h5p-91>

- ▶ Test your knowledge using this [NCLEX Next Generation-style bowtie question](#). You



- ▶ may reset and resubmit your answers to this question an unlimited number of times.¹



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://wtcs.pressbooks.pub/nursingfundamentals/?p=2040#h5p-97>

2

1. “[Chapter 13 Assignment 1](#)” by Tami Davis for [OpenRN](#) is licensed under [CC BY-NC 4.0](#)
2. Jepsen, S. (2022). *Mobility case study*. LibreTexts Studio. <https://studio.libretexts.org/h5p/6879>

XIII Glossary

OPEN RESOURCES FOR NURSING (OPEN RN)

Active assist range-of-motion exercise: A client's joint receiving partial assistance in movement from an outside force. ([Chapter 13.2](#))

Active range-of-motion exercises: Movement of a joint by the individual performing the exercise. ([Chapter 13.2](#))

Ambulation: The ability of a client to safely walk independently, with assistance from another person, or with an assistive device, such as a cane, walker, or crutches. ([Chapter 13.2](#))

Assistive device: An object or piece of equipment designed to help a client with activities of daily living, such as a walker, cane, gait belt, or mechanical lift. ([Chapter 13.2](#))

Bed mobility: The ability of a client to move around in bed, including moving from lying to sitting and sitting to lying. ([Chapter 13.2](#))

Body mechanics: The coordinated effort of muscles, bones, and the nervous system to maintain balance, posture, and alignment during moving, transferring, and repositioning clients. ([Chapter 13.2](#))

Contracture: A contracture is the lack of full passive range of motion due to joint, muscle, or soft tissue limitations. ([Chapter 13.2](#))

Fowler's positioning: A position where the client is supine with the head of bed placed at a 45- to 90-degree angle. The bed can be used to slightly flex the hips to help prevent the client from migrating downwards in bed. ([Chapter 13.2](#))

Functional mobility: The ability of a person to move around in their environment, including walking, standing up from a chair, sitting down from standing, and moving around in bed. ([Chapter 13.2](#))

Gait belt: A 2-inch-wide (5 mm) belt, with or without handles, that is fastened around a client's waist used to ensure stability when assisting clients to stand, ambulate, or to transfer from bed to chair. ([Chapter 13.2](#))

Lateral positioning: A position where the client lies on one side of the body

with the top leg over the bottom leg. This position helps relieve pressure on the coccyx. ([Chapter 13.2](#))

Mechanical lift: A hydraulic lift with a sling used to move clients who cannot bear weight or have a medical condition that does not allow them to stand or assist with moving. It can be a portable device or permanently attached to the ceiling. ([Chapter 13.2](#))

Mobility: The ability of a client to change and control body position. Mobility exists on a continuum ranging from no impairment (i.e., the client can make major and frequent changes in position without assistance) to being completely immobile (i.e., the client is unable to make even slight changes in body or extremity position without assistance). ([Chapter 13.2](#))

Orthostatic hypotension: Low blood pressure that occurs when a client changes position from lying to sitting or sitting to standing that causes symptoms of dizziness or light-headedness. Orthostatic hypotension is defined as a drop in systolic blood pressure of 20 mm Hg or more or a drop of diastolic blood pressure of 10 mm Hg or more within three minutes of sitting or standing. ([Chapter 13.2](#))

Passive range-of-motion exercises: Movement applied to a joint solely by another person or 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. ([Chapter 13.2](#))

Prone positioning: A position where the client lies on their stomach with their head turned to the side. ([Chapter 13.2](#))

Range-of-motion (ROM) exercises: Activities aimed to facilitate movement of specific joints and promote mobility of extremities. ([Chapter 13.2](#))

Semi-Fowler's positioning: A position where the head of the bed is placed at a 30- to 45-degree angle. The client's hips may or may not be flexed. ([Chapter 13.2](#))

Sims positioning: A position where the client is positioned halfway between the supine and prone positions with their legs flexed. ([Chapter 13.2](#))

Sit to stand lifts: Mobility devices that assist weight-bearing clients who are unable to transition from a sitting position to a standing position by using their own strength. They are used to safely transfer clients who have some muscular strength, but not enough strength to safely change positions by

themselves. Some sit to stand lifts use a mechanized lift whereas others are nonmechanized. ([Chapter 13.2](#))

Slider board: A board (also called a transfer board) used to transfer an immobile client from one surface to another while the client is lying supine (e.g., from a stretcher to hospital bed). ([Chapter 13.2](#))

Supine positioning: A position where the client lies flat on their back. ([Chapter 13.2](#))

Timed Get Up and Go Test: A mobility assessment by nurses that begins by having the client stand up from an armchair, walk three yards, turn, walk back to the chair, and sit down. As the client performs these maneuvers, their posture, alignment, balance, and gait are analyzed as the client's mobility status is assessed. ([Chapter 13.2](#))

Transferring: The action of a client moving from one surface to another. This includes moving from a bed into a chair or moving from one chair to another. ([Chapter 13.2](#))

Trendelenburg positioning: A position where the head of the bed is placed lower than the client's feet. This position is used in situations such as hypotension and medical emergencies because it helps promote venous return to major organs such as the brain and heart. ([Chapter 13.2](#))

Tripod position: A position where the client sits in a chair with their elbows on their knees or at the side of the bed with their arms resting on an overbed table. This position is often naturally assumed by clients with breathing difficulties. ([Chapter 13.2](#))

Vertigo: A sensation of dizziness as if the room is spinning. ([Chapter 13.2](#))

PART XIV

NUTRITION

14.1 Nutrition Introduction

OPEN RESOURCES FOR NURSING (OPEN RN)

Learning Objectives

- Describe risk factors for nutritional deficiencies
- Identify cues related to nutrition balance
- Identify diagnostic tests and lab values indicative of a disturbance in nutrition, fluid, and electrolyte disturbances
- Identify essential nutrients
- Identify supplements to enhance nutrition alterations
- Contribute to a plan of care for clients with an alteration in nutrition

Nurses promote healthy nutrition to prevent disease, assist clients to recover from illness and surgery, and teach clients how to optimally manage chronic illness with healthy food choices. Healthy nutrition helps to prevent obesity and chronic diseases, such as diabetes mellitus and cardiovascular disease. By proactively encouraging healthy eating habits, nurses provide the tools for clients to maintain their health, knowing it is easier to stay healthy than to become healthy after disease sets in. When clients are recovering from illness or surgery, nurses use strategies to promote good nutrition even when a client has a poor appetite or nausea. If a client develops chronic disease, the nurse provides education about prescribed diets that can help manage the disease, such as a low carbohydrate diet for clients with diabetes or a low fat, low salt, low cholesterol diet for clients with cardiovascular disease.

Nurses also advocate for clients with conditions that can cause nutritional deficits. For example, a nurse may be the first to notice that a client is having difficulty swallowing at mealtime and advocates for a swallow study to prevent aspiration. A nurse may also notice other psychosocial risk factors that place a client at risk for poor nutrition in their home environment and make appropriate referrals to enhance their nutritional status. Nurses also administer alternative forms of nutrition, such as enteral (tube) feedings or parenteral (intravenous) feedings.

This chapter will review basic information about the digestive system, essential nutrients, nutritional guidelines, and then discuss the application of the nursing process to address clients' nutritional status.

14.2 Nutrition Basic Concepts

OPEN RESOURCES FOR NURSING (OPEN RN)

Before discussing assessments and interventions related to promoting good nutrition, let's review the structure and function of the digestive system, essential nutrients, and nutritional guidelines.

Digestive System

The digestive system breaks down food and then absorbs nutrients into the bloodstream via the small intestine and large intestine. Because good health depends on good nutrition, any disorder affecting the functioning of the digestive system can significantly impact overall health and well-being and increase the risk of chronic health conditions.

Structure and Function

The gastrointestinal system (also referred to as the digestive system) is responsible for several functions, including digestion, absorption, and immune response. Digestion begins in the upper gastrointestinal tract at the mouth, where chewing of food occurs, called mastication. **Mastication** results in **mechanical digestion** when food is broken down into small chunks and swallowed. Masticated food is formed into a bolus as it moves toward the pharynx in the back of the throat and then into the esophagus. Coordinated muscle movements in the esophagus called **peristalsis** move the food bolus into the stomach where it is mixed with acidic gastric juices and further broken down into chyme through a **chemical digestion** process. As chyme is moved out of the stomach and into the duodenum of the small intestine, it is

mixed with bile from the gallbladder and pancreatic enzymes from the pancreas for further digestion.¹

Absorption is a second gastrointestinal function. After chyme enters the small intestine, it comes into contact with tiny fingerlike projections along the inside of the intestine called villi. Villi increase the surface area of the small intestine and allow nutrients, such as protein, carbohydrates, fat, vitamins, and minerals, to absorb through the intestinal wall and into the bloodstream. Absorption of nutrients is essential for metabolism to occur because nutrients fuel bodily functions and create energy. Peristalsis moves leftover liquid from the small intestine into the large intestine, where additional water and minerals are absorbed. Waste products are condensed into feces and excreted from the body through the anus.² for labeled parts of the gastrointestinal system.

In addition to digestion and absorption, the gastrointestinal system is also involved in immune function. Good bacteria in the stomach create a person's gut biome. Gut biome contributes to a person's immune response through antibody production in response to foreign materials, chemicals, bacteria, and other substances.³ For example, clients may develop *Clostridium difficile* (C-diff) after taking antibiotics that kill these beneficial bacteria in the gut. Read additional details about our microbiome and immune response in the "Infection" chapter of this book.

1. LibreTexts. (2024). *Anatomy and physiology (boundless)*. LibreTexts: Medicine. [https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_\(Boundless\)](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_(Boundless))
2. LibreTexts. (2024). *Anatomy and physiology (boundless)*. LibreTexts: Medicine. [https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_\(Boundless\)](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_(Boundless))
3. Human digestive system. (2019). In *Britannica*. Gastrointestinal tract as an organ of immunity. <https://www.britannica.com/science/human-digestive-system/The-gastrointestinal-tract-as-an-organ-of-immunity>

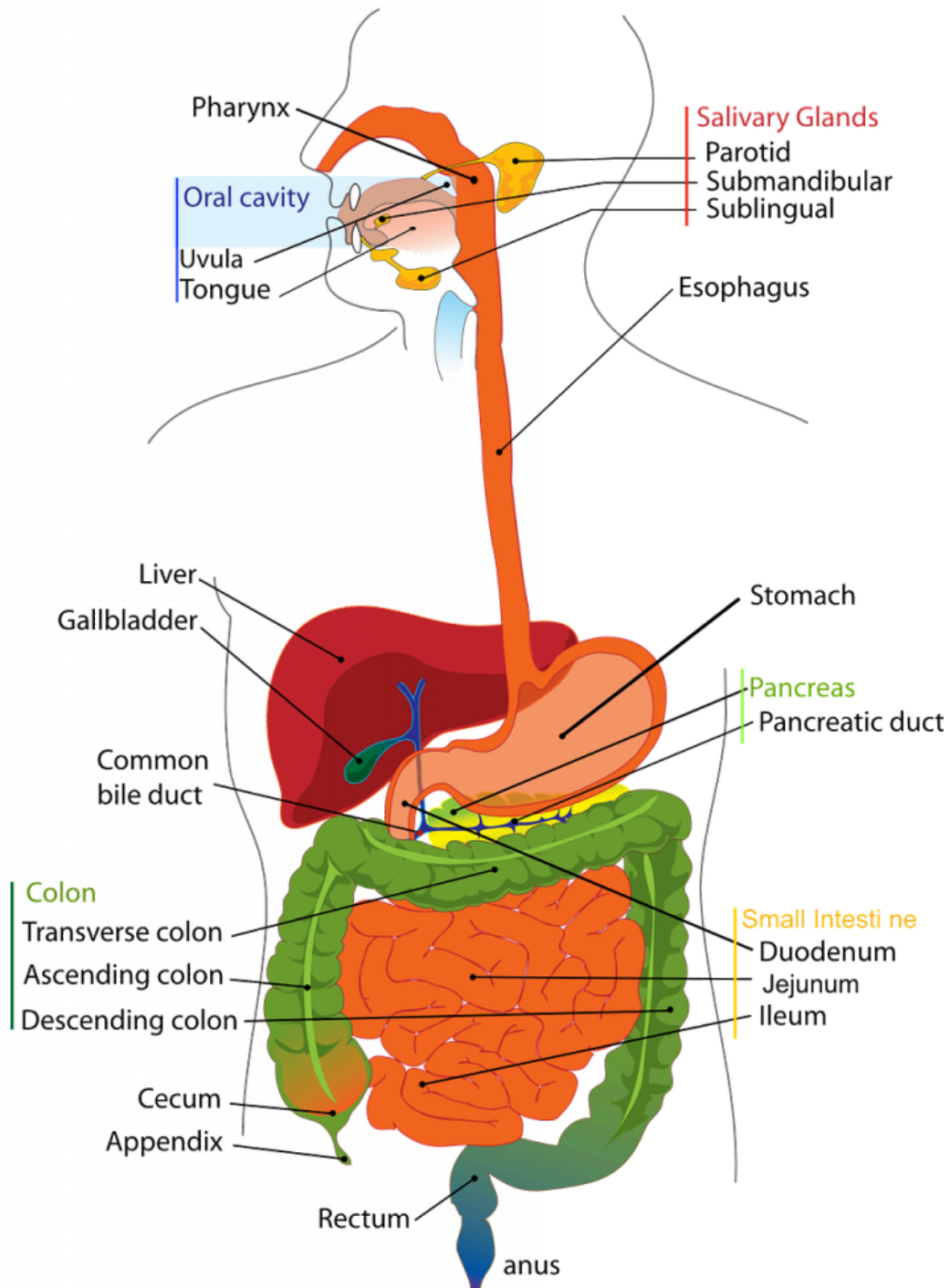


Figure 14.1 The Gastrointestinal System

Essential Nutrients

Nutrients from food and fluids are used by the body for growth, energy, and

bodily processes. **Essential nutrients** refer to nutrients that are necessary for bodily functions but must come from dietary intake because the body is unable to synthesize them. Essential nutrients include vitamins, minerals, some amino acids, and some fatty acids.⁴ Essential nutrients can be further divided into macronutrients and micronutrients.

Macronutrients

Macronutrients make up most of a person's diet and provide energy, as well as essential nutrient intake. Macronutrients include carbohydrates, proteins, and fats. However, too many macronutrients without associated physical activity cause excess nutrition that can lead to obesity, cardiovascular disease, diabetes mellitus, kidney disease, and other chronic diseases. Too few macronutrients result in undernutrition, which contributes to nutrient deficiencies and malnourishment.⁵

CARBOHYDRATES

Carbohydrates are sugars and starches and are an important energy source that provides 4 kcal/g of energy. **Simple carbohydrates** are small molecules (called monosaccharides or disaccharides) and break down quickly. As a result, simple carbohydrates are easily digested and absorbed into the bloodstream, so they raise blood glucose levels quickly. Examples of simple carbohydrates include table sugar, syrup, soda, and fruit juice. **Complex carbohydrates** are larger molecules (called polysaccharides) that break down

4. Youdim, A. (2019). *Overview of nutrition*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/nutrition-general-considerations/overview-of-nutrition>

5. Youdim, A. (2019). *Overview of nutrition*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/nutrition-general-considerations/overview-of-nutrition>

more slowly, which causes slower release into the bloodstream and a slower increase in blood sugar over a longer period of time. Examples of complex carbohydrates include whole grains, beans, and vegetables.⁶

Foods can also be categorized according to their **glycemic index**, a measure of how quickly glucose levels increase in the bloodstream after carbohydrates are consumed. The glycemic index was initially introduced as a way for people with diabetes mellitus to control their blood glucose levels. For example, processed foods, white bread, white rice, and white potatoes have a high glycemic index. They quickly raise blood glucose levels after being consumed and also cause the release of insulin, which can result in more hunger and overeating. However, foods such as fruit, green leafy vegetables, raw carrots, kidney beans, chickpeas, lentils, and bran breakfast cereals have a low glycemic index. These foods minimize blood sugar spikes and insulin release after eating, which leads to less hunger and overeating. Eating a diet of low glycemic foods has been linked to a decreased risk of obesity and diabetes mellitus.⁷ See Figure 14.2⁸ for an image of the glycemic index of various foods.

6. Youdim, A. (2019). *Overview of nutrition*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/nutrition-general-considerations/overview-of-nutrition>

7. Youdim, A. (2019). *Overview of nutrition*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/nutrition-general-considerations/overview-of-nutrition>

8. "Eat-Foods-Low-on-the-Glycemic-Index-Step-1-Version-2.jpg" by unknown is licensed under [CC BY-NC-SA 3.0](https://creativecommons.org/licenses/by-nc-sa/3.0/). Access for free at <https://www.wikihow.com/Eat-Foods-Low-on-the-Glycemic-Index#aiinfo>



Figure 14.2 Glycemic Index

PROTEINS

Proteins are peptides and amino acids that provide 4 kcal/g of energy. Proteins are necessary for tissue repair and function, growth, energy, fluid balance, clotting, and the production of white blood cells. Protein status is also referred to as **nitrogen balance**. Nitrogen is consumed in dietary intake and excreted in the urine and feces. If the body excretes more nitrogen than it takes in through the diet, this is referred to as a negative nitrogen balance. Negative nitrogen balance is seen in clients with starvation or severe infection. Conversely, if the body takes in more nitrogen through the diet than what is excreted, this is referred to as a positive nitrogen balance.⁹ During positive nitrogen balance, excess protein is converted to fat tissue for storage.

Proteins are classified as complete, incomplete, or partially complete. **Complete proteins** must be ingested in the diet. They have enough amino acids to perform necessary bodily functions, such as growth and tissue maintenance. Examples of foods containing complete proteins are soy, quinoa, eggs, fish, meat, and dairy products. **Incomplete proteins** do not

9. Youdim, A. (2019). *Overview of nutrition*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/nutrition-general-considerations/overview-of-nutrition>

contain enough amino acids to sustain life. Examples of incomplete proteins include most plants, such as beans, peanut butter, seeds, grains, and grain products. Incomplete proteins must be combined with other types of proteins to add to amino acids and form complete protein combinations.¹⁰ For example, vegetarians must be careful to eat complementary proteins, such as grains and legumes, or nuts and seeds and legumes, to create complete protein combinations during their daily food intake. **Partially complete proteins** have enough amino acids to sustain life, but not enough for tissue growth and maintenance. Because of the similarities, most sources consider partially complete proteins to be in the same category as incomplete proteins. See Figure 14.3¹¹ for an image of protein-rich foods.



Figure 14.3 Protein-Rich Foods

FATS

Fats consist of fatty acids and glycerol and are essential for tissue growth, insulation, energy, energy storage, and hormone production. Fats provide 9

10. Brazier, Y. (2020, December 10). *How much protein does a person need?* Medical News Today. <https://www.medicalnewstoday.com/articles/196279>
11. “[Protein-rich_Foods.jpg](#)” by Smastronardo is licensed under [CC BY-SA 4.0](#)

kcal/g of energy.¹² While some fat intake is necessary for energy and uptake of fat-soluble vitamins, excess fat intake contributes to heart disease and obesity. Due to its high-energy content, a little fat goes a long way.

Fats are classified as saturated, unsaturated, and trans fatty acids. **Saturated fats** come from animal products, such as butter and red meat (e.g., steak). Saturated fats are solid at room temperature. Recommended intake of saturated fats is less than 10% of daily calories because saturated fat raises cholesterol and contributes to heart disease.¹³

Unsaturated fats come from oils and plants, although chicken and fish also contain some unsaturated fats. Unsaturated fats are healthier than saturated fats. Examples of unsaturated fats include olive oil, canola oil, avocados, almonds, and pumpkin seeds. Fats containing omega-3 fatty acids are considered polyunsaturated fats and help lower LDL cholesterol levels. Fish and other seafood are excellent sources of omega-3 fatty acids.

Trans fats are fats that have been altered through a hydrogenation process, so they are not in their natural state. During the hydrogenation process, fat is changed to make it harder at room temperature and have a longer shelf life. Trans fats are found in processed foods, such as chips, crackers, and cookies, as well as in some margarines and salad dressings. Minimal trans-fat intake is recommended because it increases cholesterol and contributes to heart disease.¹⁴

12. Youdim, A. (2019). *Overview of nutrition*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/nutrition-general-considerations/overview-of-nutrition>

13. Healthwise. (2020). *Types of fats*. Michigan Medicine at University of Michigan. <https://www.uofmhealth.org/health-library/aa160619>

14. Healthwise. (2020). *Types of fats*. Michigan Medicine at University of Michigan. <https://www.uofmhealth.org/health-library/aa160619>

Micronutrients

Micronutrients include vitamins and minerals.

VITAMINS

Vitamins are necessary for many bodily functions, including growth, development, healing, vision, and reproduction. Most vitamins are considered essential because they are not manufactured by the body and must be ingested in the diet. Vitamin D is also manufactured through exposure to sunlight.¹⁵

Vitamin toxicity can be caused by overconsumption of certain vitamins, such as vitamins A, D, C, B6, and niacin. Conversely, vitamin deficiencies can be caused by various factors, including poor food intake due to poverty, malabsorption problems with the gastrointestinal tract, drug and alcohol abuse, proton pump inhibitors, and prolonged parenteral nutrition. Deficiencies can take years to develop, so it is usually a long-term problem for clients.¹⁶

Vitamins are classified as water soluble or fat soluble. **Water-soluble vitamins** are not stored in the body and include vitamin C and B-complex vitamins: B1 (thiamine), B2 (riboflavin), B3 (niacin), B6 (pyridoxine), B12 (cyanocobalamin), and B9 (folic acid). Additional water-soluble vitamins include biotin and pantothenic acid. Excess amounts of these vitamins are excreted through the kidneys in urine, so toxicity is rarely an issue, though

15. Johnson, L. E. (2022). *Overview of vitamins*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency,-dependency,-and-toxicity/overview-of-vitamins?redirectid=43#v2089966>

16. Johnson, L. E. (2022). *Overview of vitamins*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency,-dependency,-and-toxicity/overview-of-vitamins?redirectid=43#v2089966>

excess intake of vitamin B6, C, or niacin can result in toxicity.¹⁷ See Table 14.2a

¹⁷. Healthwise. (2020). *Vitamins: Their functions and sources*. Michigan Medicine at University of Michigan. <https://www.uofmhealth.org/health-library/ta3868>

for a list of selected water-soluble vitamins, their sources, and their function.^{18, 19, 20, 21, 22, 23, 24, 25}

Table 14.2a Selected Water-Soluble Vitamins

18. Healthwise. (2020). *Vitamins: Their functions and sources*. Michigan Medicine at University of Michigan. <https://www.uofmhealth.org/health-library/ta3868>
19. Johnson, L. E. (2022). *Folate deficiency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/folate-deficiency>
20. Johnson, L. E. (2022). *Niacin deficiency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/niacin-deficiency>
21. Johnson, L. E. (2022). *Riboflavin deficiency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/riboflavin-deficiency>
22. Johnson, L. E. (2022). *Thiamin deficiency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/thiamin-deficiency>
23. Johnson, L. E. (2022). *Vitamin B6 deficiency and dependency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/vitamin-b6-deficiency-and-dependency>
24. Johnson, L. E. (2022). *Vitamin B12 deficiency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/vitamin-b12-deficiency>
25. Johnson, L. E. (2022). *Vitamin C deficiency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/vitamin-c-deficiency>

Water-Soluble Vitamin	Sources	Functions	Deficiency
C (Ascorbic Acid)	Citrus fruits, broccoli, greens, sweet peppers, tomatoes, lettuce, potatoes, tropical fruits, and strawberries	Infection prevention, wound healing, collagen formation, iron absorption, amino acid metabolism, antioxidant, and bone growth in children.	Early Signs: weakness, weight loss, myalgias, and irritability. Late Signs: scurvy; swollen, spongy gums; loose teeth; bleeding gums and skin; poor wound healing; edema; leg pain; anorexia; irritability; and poor growth in children.
B1 (Thiamine)	Nuts, liver, whole grains, pork, and legumes	Nerve function; metabolism of carbohydrates, fat, amino acids, glucose, and alcohol; appetite and digestion.	Fatigue, memory deficits, insomnia, chest pain, abdominal pain, anorexia, numbness of extremities, muscle wasting, heart failure, and shock in severe cases.
B2 (Riboflavin)	Eggs, liver, leafy greens, milk, and whole grains	Protein and carbohydrate metabolism, healthy skin, and normal vision.	Pallor, lip fissures, and seborrheic dermatitis.
B3 (Niacin)	Fish, chicken, eggs, dairy, mushrooms, peanut butter, whole grains, and red meat	Glycogen metabolism, cell metabolism, tissue regeneration, fat synthesis, nerve function, digestion, and skin health.	Pellagra characterized by skin lesions at pressure points/sun exposed skin, glossitis (swollen tongue), constipation progressing to bloody diarrhea, abdominal pain, abdominal distention, nausea, psychosis, and encephalopathy.
B6 (Pyridoxine)	Organ meats, fish, and various fruits and vegetables	Protein metabolism and red blood cell formation.	Rare due to presence in most foods. Peripheral neuropathy, seizures refractory to antiseizure medications, anemia, glossitis (swollen tongue), seborrheic dermatitis, depression, and confusion.

B9 (Folic Acid)	Liver, legumes, leafy greens, seeds, orange juice, and enriched refined grains	Coenzyme in protein metabolism and cell growth, red blood cell formation, and prevention of fetal neural tube defects in utero.	Glossitis (swollen tongue), confusion, depression, diarrhea, anemia, and fetal neural tube defects.
B12 (Cyanocobalamin)	Meat, organ meat, dairy, seafood, poultry, and eggs	Mature red blood cell formation, DNA/RNA synthesis, new cell formation, and nerve function.	Pernicious anemia from lack of intrinsic factor in intestines. Early Signs: weight loss, abdominal pain, peripheral neuropathy, weakness, hyporeflexia, and ataxia. Late Signs: irritability, depression, paranoia, and confusion.

Fat-soluble vitamins are absorbed with fats in the diet and include vitamins A, D, E, and K. They are stored in fat tissue and can build up in the liver. They are not excreted easily by the kidneys due to storage in fatty tissue and the liver, so overconsumption can cause toxicity, especially with vitamins A and

D.²⁶ See Table 14.2b for a list of selected fat-soluble vitamins, their sources, their function, and manifestations of deficiencies and toxicities.^{27 28 29 30 31 32 33 34}

26. Healthwise. (2020). *Vitamins: Their functions and sources*. Michigan Medicine at University of Michigan. <https://www.uofmhealth.org/health-library/ta3868>
27. Healthwise. (2020). *Vitamins: Their functions and sources*. Michigan Medicine at University of Michigan. <https://www.uofmhealth.org/health-library/ta3868>
28. Johnson, L. E. (2022). *Vitamin A deficiency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/vitamin-a-deficiency>
29. Johnson, L. E. (2022). *Vitamin D deficiency and dependency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/vitamin-d-deficiency-and-dependency>
30. Johnson, L. E. (2022). *Vitamin D toxicity*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/vitamin-d-toxicity>
31. Johnson, L. E. (2022). *Vitamin E deficiency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency,-dependency,-and-toxicity/vitamin-e-deficiency>
32. Johnson, L. E. (2022). *Vitamin E toxicity*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/vitamin-e-toxicity>
33. Johnson, L. E. (2022). *Vitamin K deficiency*. Merck Manual Professional Version. <https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/vitamin-k-deficiency>
34. Johnson, L. E. (2022). *Vitamin K toxicity*. Merck Manual Professional Version.

Table 14.2b Selected Fat-Soluble Vitamins

<https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/vitamin-k-toxicity>

Fat-Soluble Vitamin	Source	Function	Deficiency	Toxicity
A (Retinol)	Retinol: fortified milk and dairy, egg yolks, and fish liver oil Beta carotene: green leafy vegetables, and dark orange fruits and vegetables	Eyesight, epithelial, bone and tooth development, normal cellular proliferation, and immunity.	Night blindness, rough scaly skin, dry eyes, and poor tooth/ bone development. Causes poor growth and infections common with mortality >50%.	Dry, itchy skin; headache; nausea; blurred vision; and yellowing skin (carotenosis).
D	Milk, dairy, sun exposure, egg yolks, fatty fish, and liver	Changed to active form with sun exposure. Needed for calcium/ phosphorus absorption, immunity, and bone strength.	Rickets, poor dentition, tetany, osteomalacia, muscle aches and weakness, bone pain, poor calcium absorption leading to hypocalcemia and subsequent hyperparathyroidism and tetany.	Hypercalcemia resulting in nausea, vomiting, anorexia, renal failure, weakness, pruritus, and polyuria.
E	Green leafy vegetables, whole grains, liver, egg yolks, nuts, and plant oils	Anticoagulant, antioxidant, and cellular protection.	Red blood cell breakdown leading to anemia, neuron degeneration, neuropathy, and retinopathy.	Rare. Occasionally muscle weakness, fatigue, GI upset with diarrhea, and hemorrhagic stroke.

K	Green leafy vegetables and green vegetables *Produced by bacteria in intestines	Needed for producing clotting factors in the liver.	Rare in adults. Prolonged clotting times, hemorrhaging (especially in newborns causing morbidity & mortality), and jaundice.	Rare, but can interfere with effectiveness of certain anticoagulant medications (Warfarin).
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MINERALS

Minerals are inorganic materials essential for hormone and enzyme production, as well as for bone, muscle, neurological, and cardiac function. Minerals are needed in varying amounts and are obtained from a well-rounded diet. In some cases of deficiencies, mineral supplements may be prescribed by a health care provider. Deficiencies can be caused by malnutrition, malabsorption, or certain medications, such as diuretics.

Minerals are classified as either macrominerals or trace minerals.

Macrominerals are needed in larger amounts and are typically measured in milligrams, grams, or milliequivalents. Macrominerals include sodium, potassium, calcium, magnesium, chloride, and phosphorus. Macrominerals are discussed in further detail in the “Electrolytes” section of the “[Fluids and Electrolytes](#)” chapter of this book.

Trace minerals are needed in tiny amounts. Trace minerals include zinc, iron, chromium, copper, fluorine, iodine, manganese, molybdenum, and

selenium.³⁵ See Table 14.2c for a list of selected macrominerals and Table 14.2d for a list of trace minerals.^{36 37}

Table 14.2c Macrominerals

Macromineral	Source	Function
Sodium	Table salt, spinach, and milk	Water balance
Potassium	Legumes, potatoes, bananas, and whole grains	Muscle contraction, cardiac muscle function, and nerve function
Calcium	Dairy, eggs, and green leafy vegetables	Bone and teeth development, nerve function, muscle contraction, immunity, and blood clotting
Magnesium	Raw nuts, spinach (cooked has higher magnesium content), tomatoes, and beans	Cell energy, muscle function, cardiac function, and glucose metabolism
Chloride	Table salt	Fluid and electrolyte balance and digestion
Phosphorus	Red meat, poultry, rice, oats, dairy, and fish	Bone strength and cellular function

Table 14.2d Trace Minerals

35. U.S. National Library of Medicine. (2024). *Minerals*. MedlinePlus.

<https://medlineplus.gov/minerals.html>

36. Texas Heart Institute. (n.d.). *Minerals: What they do, where to get them*.

<https://www.texasheart.org/heart-health/heart-information-center/topics/minerals-what-they-do-where-to-get-them/>

37. Texas Heart Institute. (n.d.). *Trace elements: What they do and where they get them*.

<https://www.texasheart.org/heart-health/heart-information-center/topics/trace-elements/>

Trace Mineral	Source	Function
Zinc	Eggs, spinach, yogurt, whole grains, fish, and brewer's yeast	Immune function, healing, and vision
Iron	Red meat, organ meats, spinach, shrimp, tuna, salmon, kidney beans, peas, and lentils (nonanimal forms are harder to absorb, so need more!)	Hemoglobin production and collagen production
Chromium	Whole grains, meat, and brewer's yeast	Glucose metabolism
Copper	Shellfish, fruits, nuts, and organ meats	Hemoglobin production, collagen, elastin, neurotransmitter production, and melanin production
Fluorine	Fluoridated water and toothpaste	Retention of calcium in bones and teeth
Iodine	Iodized salt and seafood	Energy production and thyroid function
Manganese	Whole grain and nuts	Not fully understood
Molybdenum	Organ meats, green leafy vegetables, legumes, whole grains, and dairy	Not fully understood; detoxification
Selenium	Broccoli, cabbage, garlic, whole grains, brewer's yeast, celery, onions, and organ meats	Not fully understood

Nutritional Guidelines

Nutritional guidelines are developed by governmental agencies to provide guidance to the population on how to best meet nutritional needs. These guidelines may vary by country. The National Academies of Sciences, Engineering, and Medicine set the **Dietary Reference Intakes** (DRIs) for the United States and Canada. Dietary Reference Intakes (DRIs) are a set of reference values used to plan and assess nutrient intakes of healthy people, including proteins, carbohydrates, fats, vitamins, minerals, and fiber. Nutrients

included in the DRIs are obtained through a typical diet, although some foods may be fortified with certain nutrients that are commonly deficient in diets.³⁸

Choose MyPlate Food Guide

The U.S. Department of Agriculture (USDA) issues dietary guidelines for appropriate serving sizes of each food group and number of servings recommended each day. The “Choose MyPlate” food guide is an easy-to-understand visual representation of how a healthy plate of food should be divided based on food groups. See Figure 14.4³⁹ for a Choose MyPlate image. A little more than half of the plate should be grains and vegetables, with a focus on whole grains and a variety of vegetables. About one quarter of the plate should be fruits, with an emphasis on whole fruits. About one quarter of the plate should be protein, with an emphasis on consuming a variety of low-fat protein sources. All of these groups combined should make up no more than 85% of daily caloric intake based on a 2,000-calorie diet. Fats, oils, and added sugars are not included, but should make up no more than 15% of daily caloric intake. Foods should be selected that are as nutrient-dense as possible.

Nutrient-dense foods mean there is a high proportion of nutritional value relative to calories contained in the food, such as fruits and vegetables.

Conversely, **calorie-dense foods** should be minimized because they have a large amount of calories with few nutrients. For example, candy and soda are

38. U.S. Department of Agriculture and U.S. Department of Health and Human Services. (2020). *Dietary guidelines for Americans, 2020-2025* (9th ed.). <https://www.dietaryguidelines.gov/>

39. “[MyPlate_blue.png](#)” by [USDA](#) is licensed under [CC0](#)

calorie-dense with few nutrients and should be minimized.^{40, 41} See Figure 14.5 for an image of MyPlate⁴²

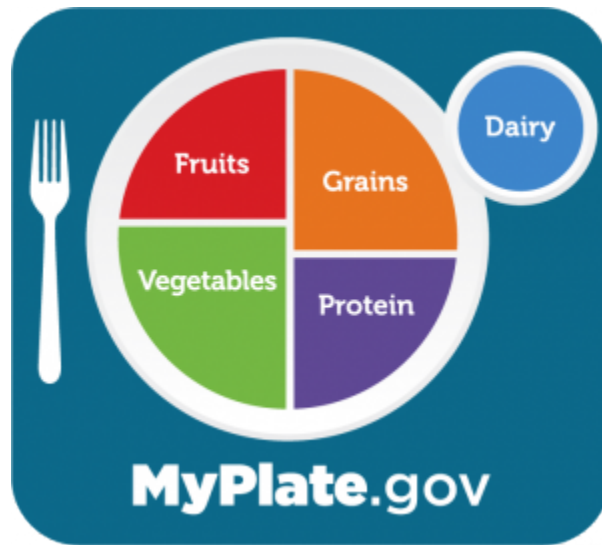


Figure 14.4 MyPlate Food Guide

- ▶ Read more about USDA MyPlate guidelines at <https://www.myplate.gov/>.

MyPlate information and images are also available in several other languages so that education can be tailored to the client's preferred language. For

40. U.S. Department of Agriculture and U.S. Department of Health and Human Services. (2020). *Dietary guidelines for Americans, 2020-2025* (9th ed.). <https://www.dietaryguidelines.gov/>

41. USDA MyPlate. (n.d.). *What's on your plate?* U.S. Department of Agriculture. <https://www.myplate.gov/>

42. "MyPlate_blue.png" by USDA is licensed under [CC0](https://creativecommons.org/licenses/by/4.0/)