

MEDICAL ASSISTANT - INTRODUCTION TO CLINICAL SKILLS



Karrie Stanfill
Colorado Mesa University

Medical Assistant - Introduction to Clinical Skills

Karrie Stanfill

Colorado Mesa University

This text is disseminated via the Open Education Resource (OER) LibreTexts Project (<https://LibreTexts.org>) and like the thousands of other texts available within this powerful platform, it is freely available for reading, printing, and "consuming."

The LibreTexts mission is to bring together students, faculty, and scholars in a collaborative effort to provide an accessible, and comprehensive platform that empowers our community to develop, curate, adapt, and adopt openly licensed resources and technologies; through these efforts we can reduce the financial burden born from traditional educational resource costs, ensuring education is more accessible for students and communities worldwide.

Most, but not all, pages in the library have licenses that may allow individuals to make changes, save, and print this book. Carefully consult the applicable license(s) before pursuing such effects. Instructors can adopt existing LibreTexts texts or Remix them to quickly build course-specific resources to meet the needs of their students. Unlike traditional textbooks, LibreTexts' web based origins allow powerful integration of advanced features and new technologies to support learning.



LibreTexts is the adaptable, user-friendly non-profit open education resource platform that educators trust for creating, customizing, and sharing accessible, interactive textbooks, adaptive homework, and ancillary materials. We collaborate with individuals and organizations to champion open education initiatives, support institutional publishing programs, drive curriculum development projects, and more.

The LibreTexts libraries are Powered by [NICE CXone Expert](#) and was supported by the Department of Education Open Textbook Pilot Project, the California Education Learning Lab, the UC Davis Office of the Provost, the UC Davis Library, the California State University Affordable Learning Solutions Program, and Merlot. This material is based upon work supported by the National Science Foundation under Grant No. 1246120, 1525057, and 1413739.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation nor the US Department of Education.

Have questions or comments? For information about adoptions or adaptations contact info@LibreTexts.org or visit our main website at <https://LibreTexts.org>.

This text was compiled on 05/06/2026

TABLE OF CONTENTS

[Licensing](#)

[Techniques and Skills](#)

- [Infection Control](#)
- [Infection](#)
- [Natural Defenses Against Infection](#)
- [Infection Treatment](#)
- [Preventing Infection](#)
- [Hand Hygiene](#)
- [Respiratory Hygiene](#)
- [Personal Protective Equipment \(PPE\)](#)
- [Environmental Measures](#)
- [Aseptic Technique](#)
- [Providing Patient Care](#)
- [Initiating Patient Interaction](#)
- [Blood Pressure](#)
- [General Survey](#)
- [Oxygen Saturation](#)
- [Pulse](#)
- [Respiratory Rate](#)
- [Temperature](#)
- [Vital Signs](#)

[Index](#)

[Glossary](#)

[Detailed Licensing](#)

[Detailed Licensing](#)

Licensing

A detailed breakdown of this resource's licensing can be found in [Back Matter/Detailed Licensing](#).

Some of the content in this textbook was adapted from the following open educational resources or materials available in the public domain. Attribution is given to the authors and contain the individual licenses listed below:

NURSING SKILLS

- Attributed to Chippewa Valley Technical College
- Editors: Kimberly Ernstmeyer, MSN, RN, CNE, CHSE, APN_PC and Elizabeth Christman, DNP, RN, CNE
- Original version can be found [here](#)
- Licensed under [CC by 4.0](#)

NURSING FUNDAMENTALS

- Attributed to Chippewa Valley Technical College
- Editors: Kimberly Ernstmeyer, MSN, RN, CNE, CHSE, APN_PC and Elizabeth Christman, DNP, RN, CNE
- Original version can be found [here](#)
- Licensed under [CC by 4.0](#)

[World Health Organization \(WHO\)](#)

[Centers for Disease Control and Prevention \(CDC\)](#)

[American Heart Association \(AHA\)](#)

CHAPTER OVERVIEW

Techniques and Skills

- Infection Control
- Infection
- Natural Defenses Against Infection
- Infection Treatment
- Preventing Infection
- Hand Hygiene
- Respiratory Hygiene
- Personal Protective Equipment (PPE)
- Environmental Measures
- Aseptic Technique
- Providing Patient Care
- Initiating Patient Interaction
- Blood Pressure
- General Survey
- Oxygen Saturation
- Pulse
- Respiratory Rate
- Temperature
- Vital Signs

This page titled [Techniques and Skills](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Infection Control

There are many factors that affect the body's ability to defend against infection and place individuals at risk of developing an infection. When an infection occurs, 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 healthcare professionals.

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.

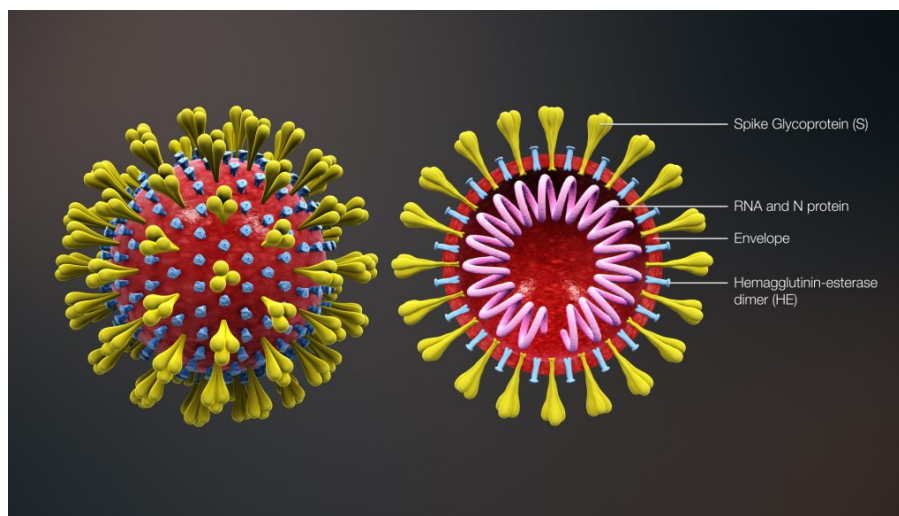
Pathogens

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

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.

Antiviral medications can be used to treat some viral infections. **Antibiotics do not kill viruses and are ineffective as a treatment for viral infections.**



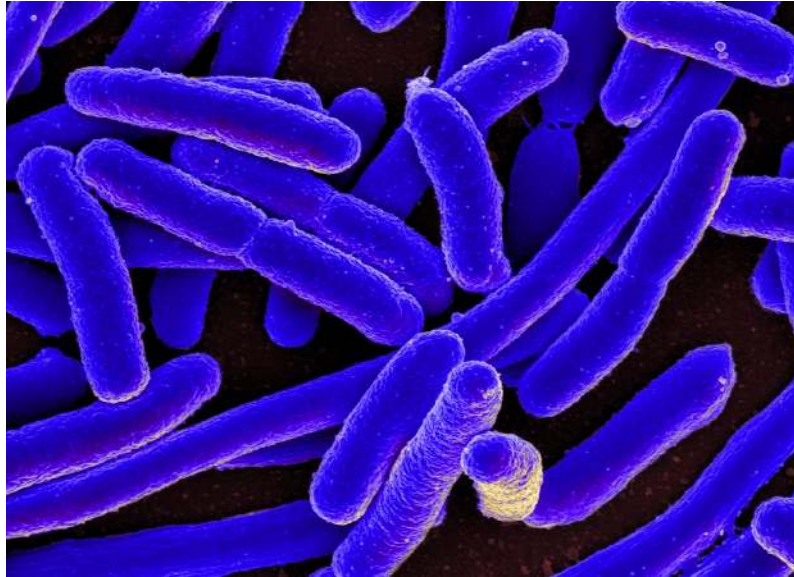
Coronavirus

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.

A patient 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.



E. coli Bacteria

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 patients or those taking antibiotics.

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.



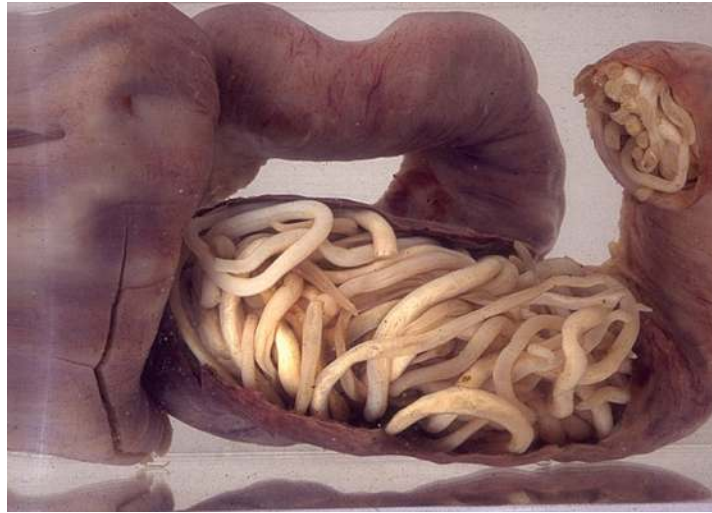
Oral Thrush

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.



Helminth Infection

This page titled [Infection Control](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Infection

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.

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 *B. 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, 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 patient.

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, patients undergoing chemotherapy, people with immunodeficiencies (such as acquired immunodeficiency syndrome [AIDS]), patients who are recovering from surgery, and those who have nonintact skin (such as a severe wound or burn).

An example of a primary pathogen is enterohemorrhagic *E. coli* that produces a toxin that leads to severe and bloody diarrhea, inflammation, and renal failure, even in patients with healthy immune systems. *Staphylococcus epidermidis*, on the other hand, is an opportunistic pathogen that is a frequent cause of health-care acquired infection. *S. 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 procedures. Once inside the body, it can cause serious infections such as endocarditis.

Other members of normal flora can cause opportunistic infections. For example, 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.

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 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 patient's saliva that provides an optimal environment for the growth of *Candida*, resulting in oral thrush. Immunodeficiencies, such as those seen in patients with HIV, AIDS, and cancer, also lead to *Candida* infections.

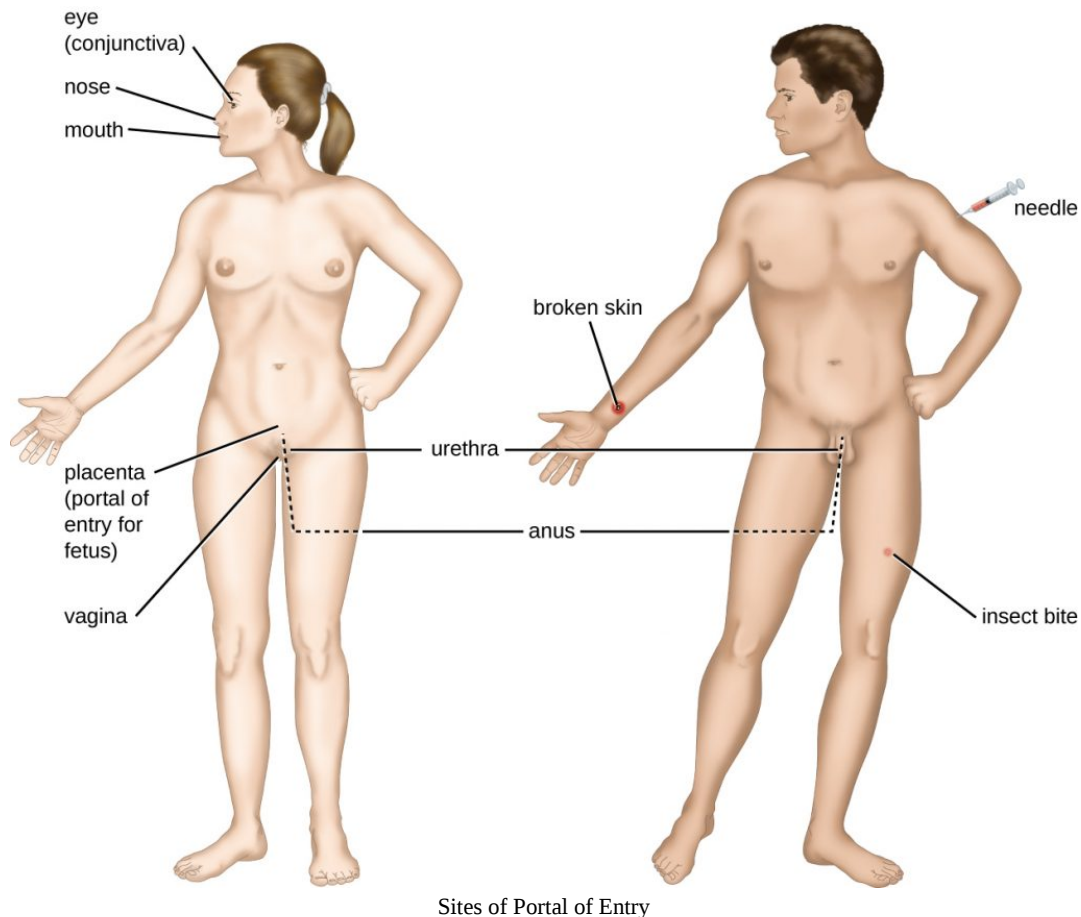
Stages of Pathogenesis

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.

1. 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.



2. 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.

3. 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.

4. 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.**

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

In a **secondary infection** a localized pathogen, or the toxins it produces, can spread to a secondary location. For example, a dental hygienist nicking a patient's gum with a sharp tool can cause a local infection in the gum by *Streptococcus* bacteria found in the oral normal flora. The *Streptococcus* bacteria may then gain access to the bloodstream and make their way to other locations within the body such as the heart valves, resulting in a secondary infection.

When an infection spreads 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.

Sometimes a primary infection can lead to a secondary infection by an opportunistic pathogen. For example, when a patient experiences a primary infection from influenza, it can damage and decrease the defense mechanisms of the lungs, making the patient 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 opening for opportunistic pathogens like *Clostridium difficile* or *Candida Albicans* to cause a secondary infection.

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**.

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 104°F (38°) or under 96.8°F (36°C)
- Heart rate greater than 90 beats/minute
- Respiratory rate greater than 20 breaths/minute
- White blood cell count greater than 12,000 or less than 4,000 /microliters or over 10% of immature forms (bands)

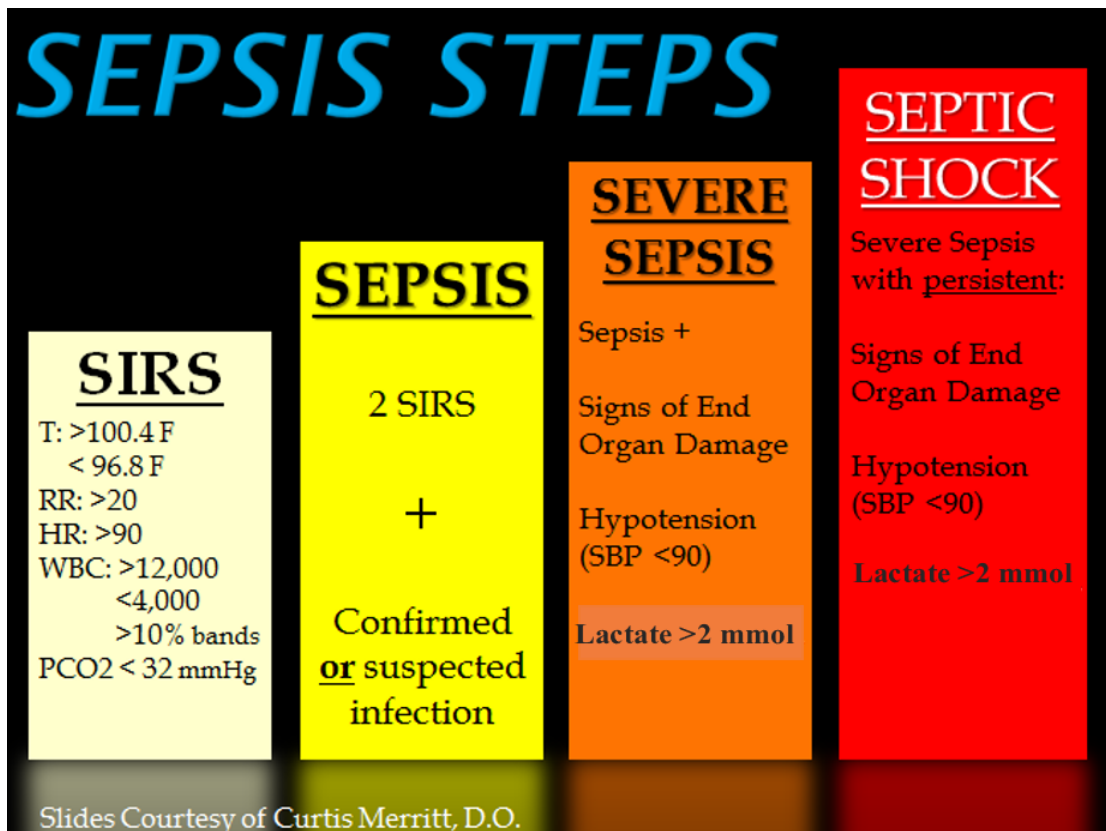
Even though the purpose of SIRS is to defend against a noxious stressor, the uncontrolled release of massive amounts of cytokines, called cytokine storm, can lead to organ dysfunction and even death.

Click the following link to watch [ICU Advantage YouTube Video " The COVID-19 Cytokine Sorm Explained"](#) (25:34 min)

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 9.12[21] 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.



Progression of Sepsis

Click the following link to watch [khanacademymedicine's YouTube video: Sepsis: Systemic inflammatory response syndrome \(SIRS\) to multiple organ dysfunction syndrome \(MODS\)](#) (7:43 min)

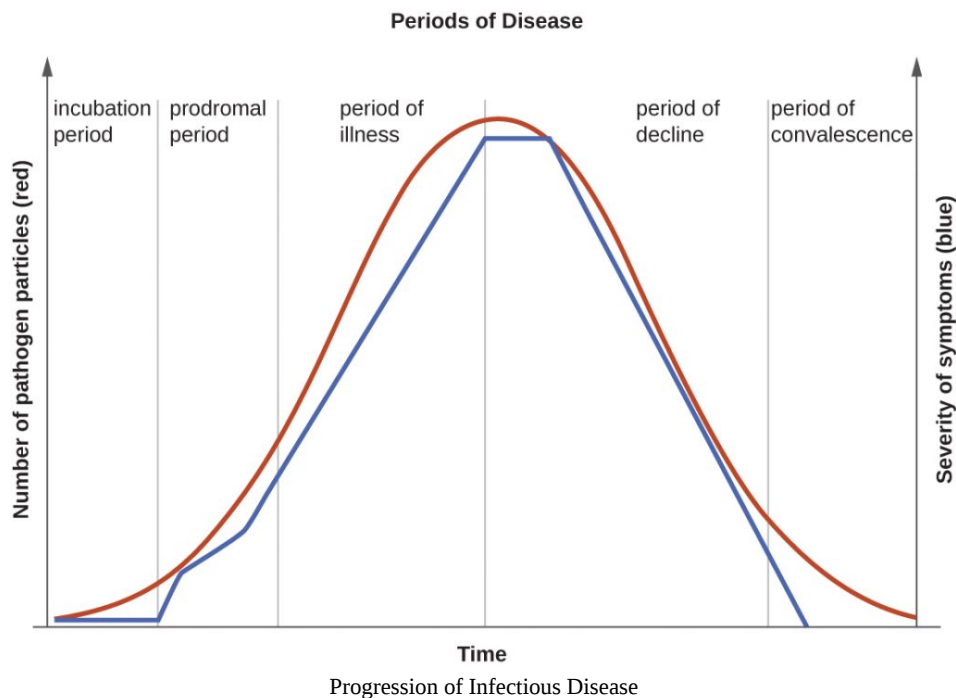
Toxins

Some pathogens release toxins that are biological poisons that assist in their ability to invade and cause damage to tissues. For example, Botulinum toxin (also known as botox) 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.

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 healthcare providers to encourage individuals to regularly receive tetanus vaccination boosters throughout their lifetimes.

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.



1. 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 patient is unaware that a disease is beginning to develop.

2. 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.

3. Convalescent Period

The final period of disease is known as the **convalescent period**. During this stage, the patient generally returns to normal daily functioning, although some diseases may inflict permanent damage that the body cannot fully repair. For example, if a strep infection becomes systemic and causes a secondary infection of the patient'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), patients 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 patient 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.

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. Conversely, chronic infections may persist for months. Hepatitis and mononucleosis are examples of chronic infections.

Healthcare-Associated Infections

An infection that is contracted in a health care facility or under medical care is known as a **healthcare-associated infection (HAI)**, formerly referred to as a nosocomial infection. On any given day, about one in 31 hospital patients 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.

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)

Blood-borne Pathogens

Blood-borne pathogens are potentially present in a patient's blood and body fluids, placing other patients 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 health care worker experiences exposure due to a needlestick injury or the splashing of body fluids, it should be immediately reported so that careful monitoring can occur. When the source of the exposure is known, the health care worker and patient are initially tested. Repeat testing and medical prophylaxis may be warranted for the health care worker, depending on the results.

Source

book used: Nursing Fundamentals

This page titled [Infection](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Natural Defenses Against Infection

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

textbook link: [Nursing Skills](#)

Nonspecific Innate Immunity

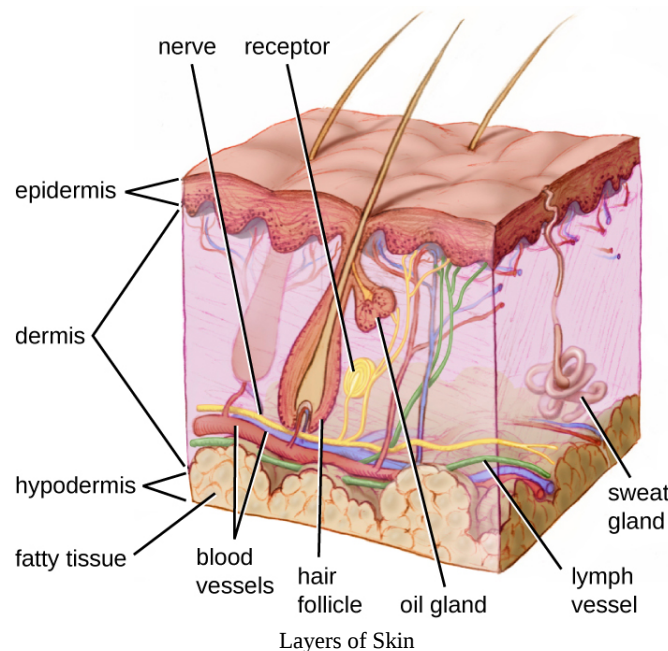
Nonspecific innate immunity is a system of defenses in the body that targets invading pathogens in a nonspecific manner. It is called “innate” because it is present from the moment we are born. Nonspecific innate immunity includes physical defenses, chemical defenses, and cellular defenses.

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.

SKIN

One of the body’s most important physical barriers is the skin barrier, which is composed of three layers of closely packed cells. 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.

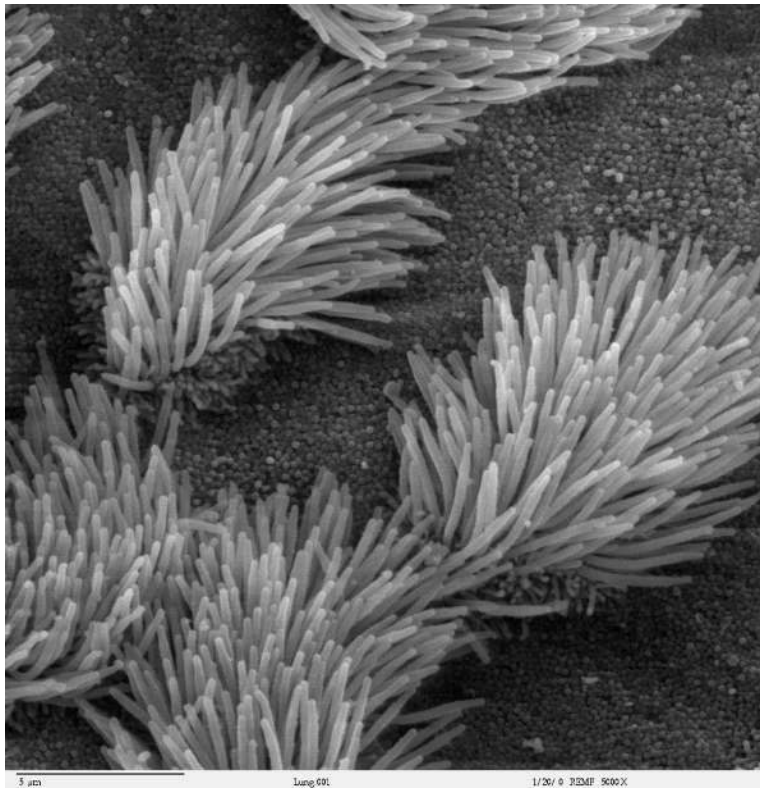


MUCUS MEMBRANES

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.

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.

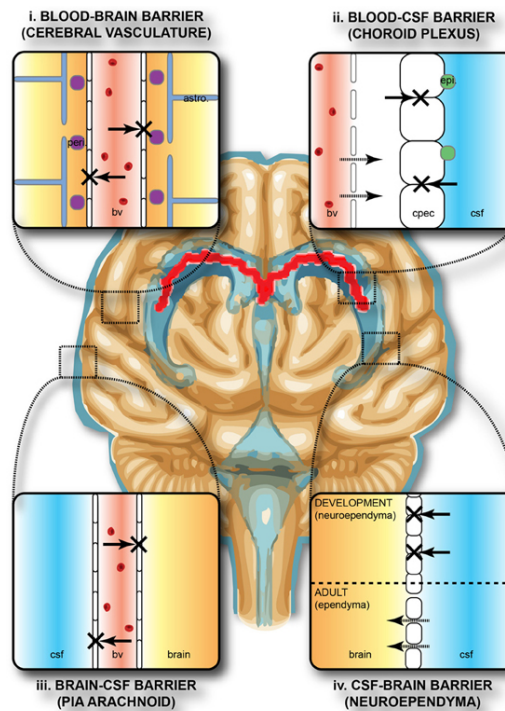


Mucociliary Escalator

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 the mechanical action of peristalsis (a series of muscular contractions in the digestive tract) moves this mixture through the intestines and excretes it in feces. For this reason, feces can contain microorganisms that can cause the spread of infection; therefore, good hand hygiene is vital.

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.



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 are flushed out by the mechanical action of blinking, which bathes the eye in tears, washing debris away.



Eyelashes Are Mechanical Defenses

Normal flora that contribute 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 prevent the early steps of pathogen attachment and proliferation required for the establishment of an infection. For example, in the vagina, normal flora compete 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 pathogens on the skin, in the upper respiratory tract, and in the gastrointestinal tract.

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 patient as a method of restoring their normal flora.

Chemical Defenses

In addition to physical defenses, our nonspecific innate immune system uses several chemical mediators that inhibit microbial invaders. The term chemical mediators encompasses 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 more dry and susceptible to pathogens normally 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.

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.

PLASMA PROTEIN MEDIATORS

An example of an acute-phase protein is C-reactive protein. High levels of C-reactive protein indicate a serious infection or other medical condition that causes inflammation is occurring.

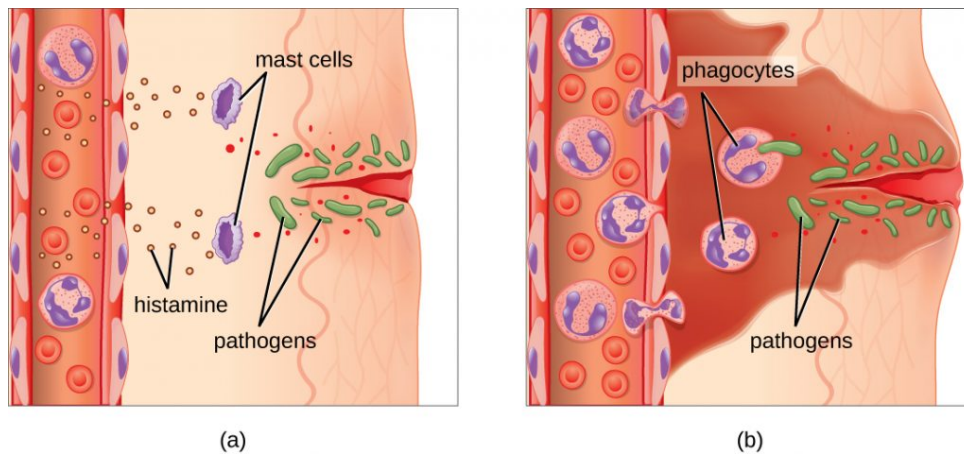
Complement proteins are always present in the blood and tissue fluids, allowing them to be activated quickly. They aid in the destruction of pathogens by piercing their outer membranes (cell lysis) or by making them more attractive to phagocytic cells such as macrophages.

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

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.

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 infection.



Inflammatory Response

1. demonstrating when mast cells detect injury to nearby cells and release histamine, initiating an inflammatory response
2. 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. During injury, if this nonspecific inflammatory process does not successfully kill the pathogens, infection occurs.

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 patient'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.

A low-level fever is thought to help an individual overcome an illness. 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 108° (42 °C) that must be managed to prevent tissue injury and death.

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.

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.

B cells 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. The five classes of antibodies are IgG, IgM, IgA, IgD, and IgE. They also turn into memory B cells.

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.

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 re-exposure, 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.

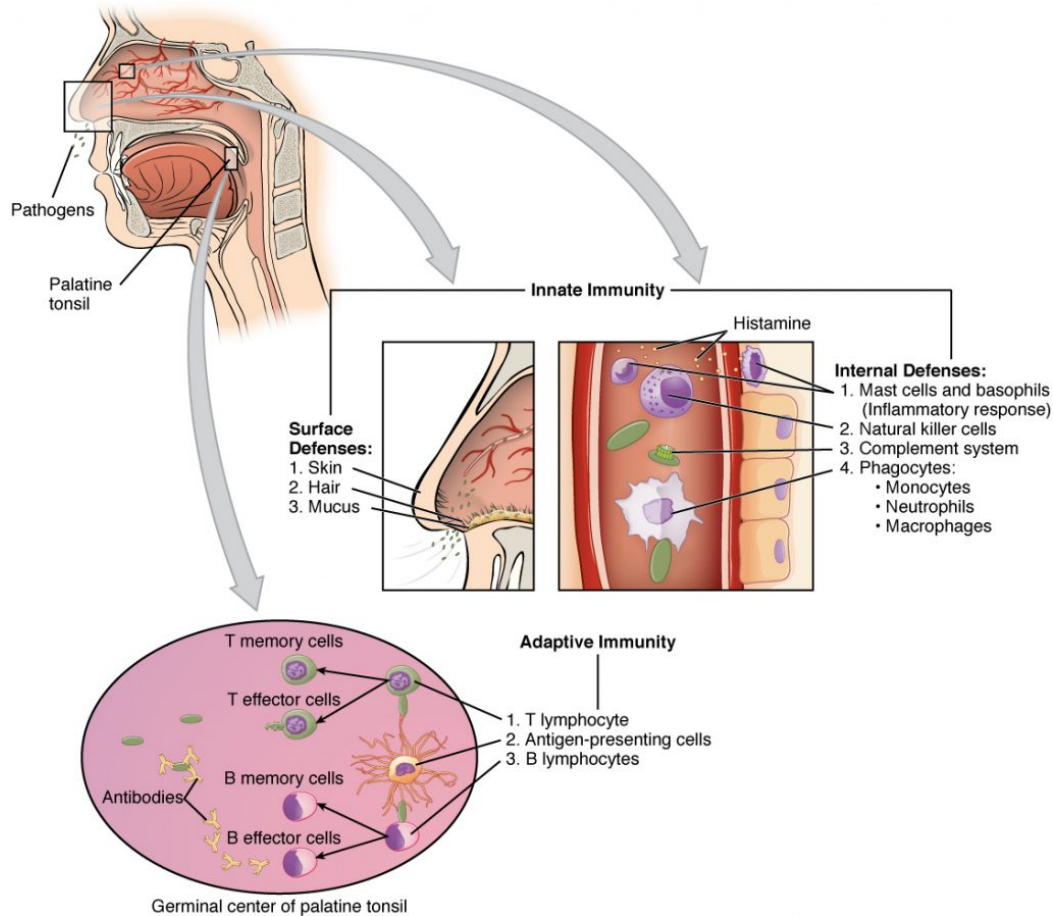


Illustration of innate immunity and specific adaptive immunity that occurs in response to a pathogen entering the body through the nose.

This page titled [Natural Defenses Against Infection](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Infection Treatment

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.

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.

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.

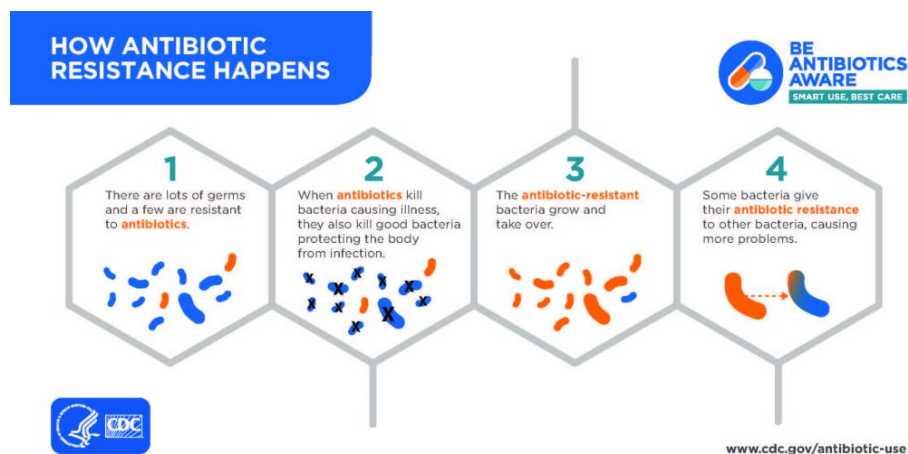
Antimicrobial stewardship is a coordinated program that promotes the appropriate use of antimicrobials (including antibiotics), improves patient outcomes, reduces microbial resistance, and decreases the spread of infections caused by multidrug-resistant organisms.

Click the following CDC links to read more about:

- Antibiotic Stewardship - Outpatient Facilities
- Improving Antibiotic Use
- About Antibiotic Use
- Adult Outpatient Treatment Recommendations
- Antibiotics Quiz

CDC Video links:

- [The Story of Peggy Lillis The Other Side of Antibiotics \(2:40 min\)](#)



Antibiotic Resistance

The healthcare providers plays an important role in antimicrobial stewardship through patient education. For example, many patients expect to receive an antibiotic when they seek treatment for an illness or symptom. However, because antibiotics are only effective in treating bacteria, the patient should be educated regarding effective treatment for the type of pathogen causing their symptoms. If an antibiotic is prescribed, patients should be advised to complete the entire course of therapy or contact their provider if they are unable to do so. For example, patients 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 patient education regarding prescribed antibiotic therapy.

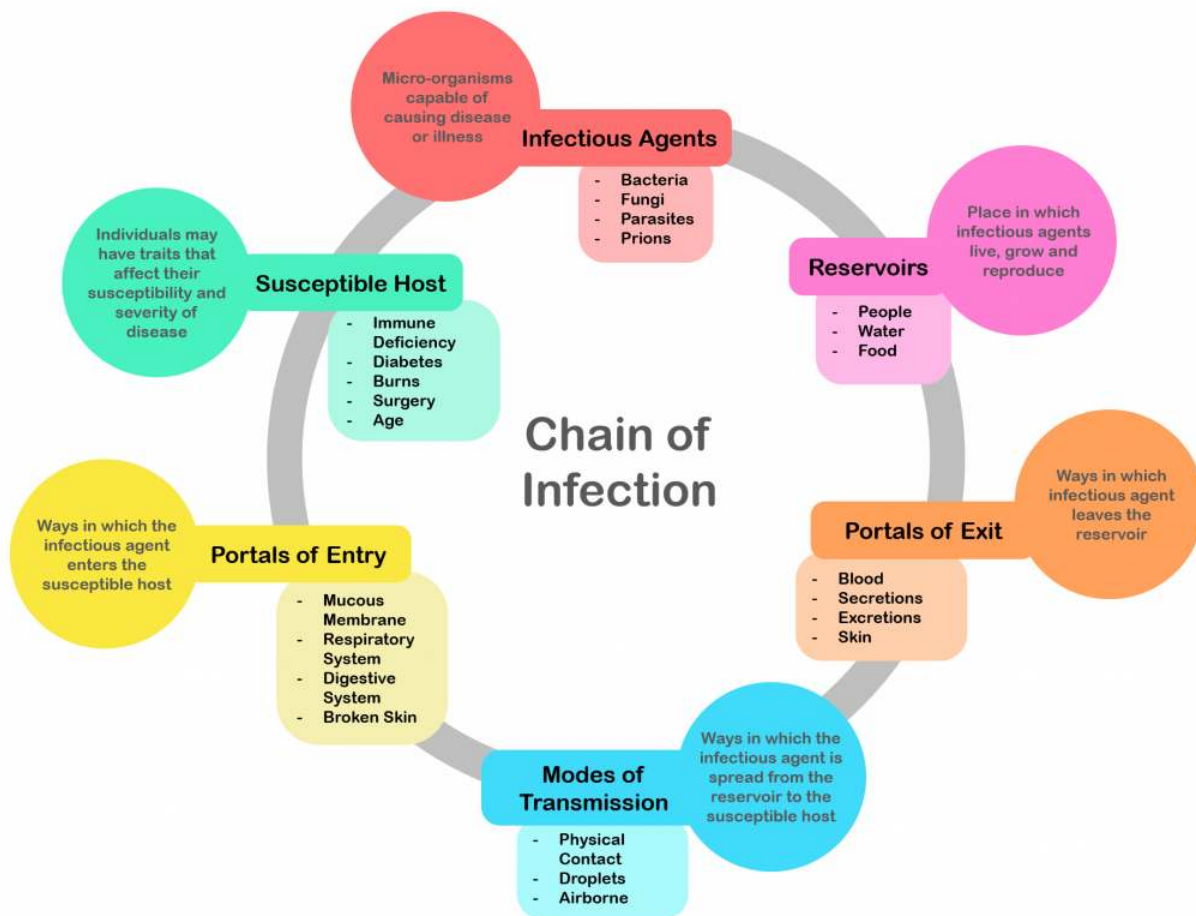
Click the following CDC links to read more about:

- [About Antimicrobial Resistance](#)
- [How Antimicrobial Resistance Happens](#)
- [5 Things To Know](#)

This page titled [Infection Treatment](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Preventing Infection

Medical assistants 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 the picture below of the links within the chain of infection.



Chain of Infection

The Chain of Infection links are described as the following:

- **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.

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.

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 patients 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]

Standard and Transmission-Based Precautions

To protect patients and health care workers from the spread of pathogens, the CDC has developed precautions to use during patient 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 patients 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 patient care, regardless of suspected or confirmed infection status of the patient, 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 patient from potential transmission of infectious organisms.

Current standard precautions according to the CDC include the following:

- Appropriate hand hygiene
- Use of personal protective equipment (e.g., gloves, gowns, masks, eyewear) whenever infectious material exposure may occur.
- Appropriate patient 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
- Sharps safety (i.e., engineering and work practice controls)
- Aseptic technique for invasive nursing procedures such as parenteral medication administration

Transmission-Based Precautions

In addition to standard precautions, transmission-based precautions are used for patients 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 patients with these types of pathogens, standard precautions are used along with specific transmission-based precautions.

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 the table below outlining the categories of transmission precautions with associated PPE and other precautions.

Transmission-Based Precautions

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 Note: Use only soap and water for hand hygiene in patients with <i>C. difficile</i> infection
Enhanced barrier	Used during high-contact resident care activities for individuals colonized or infected with a multidrug-resistant organism (MDRO) as well as those at increased risk of MDRO acquisition	- Glove - Gown
Droplet	Known or suspected infection with pathogens transmitted by large respiratory droplets generated by coughing, sneezing, or talking, such as influenza, coronavirus, or pertussis	- Mask - Goggles or face shield
Airborne	Known or suspected infection with pathogens transmitted by small respiratory droplets, such as measles, tuberculosis, and disseminated herpes zoster	Fit-tested N-95 respirator or PAPR - Airborne infection isolation room - Single patient room - Patient door closed - Restricted susceptible personnel room entry

When possible, patients with transmission-based precautions should be placed in a single occupancy room with dedicated patient care equipment (e.g., blood pressure cuffs, stethoscope, and thermometer stay in the patient's room). A card is posted outside the door alerting staff and visitors to required precautions before entering the room. See picture below for an example of signage used for a patient with contact precautions. Transport of the patient and unnecessary movement outside the patient room should be limited.



Contact Precautions Sign

- **Disinfection** - Removal of organisms from inanimate objects and surfaces.
- **Sterilization** - Removal of organisms from inanimate objects and surfaces.
- **Standard precautions** - The minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infection status of the patient, in any setting where healthcare is

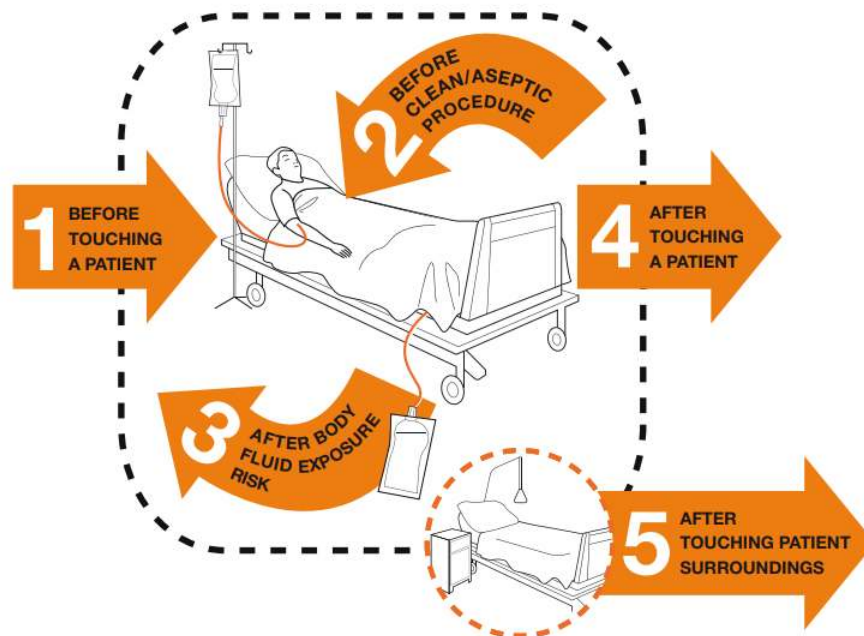
This page titled [Preventing Infection](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Hand Hygiene

Hand hygiene is the best and most effective way to 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. 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 following:

- Immediately before touching a patient
- Before performing an aseptic task or handling invasive devices
- Before moving from a soiled body site to a clean body site on a patient
- After touching a patient or their immediate environment
- After contact with blood, body fluids, or contaminated surfaces (with or without glove use)
- Immediately after glove removal[9]

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.



Five Moments of Hand Hygiene

1 BEFORE TOUCHING A PATIENT	WHEN? Clean your hands before touching a patient when approaching him/her. WHY? To protect the patient against harmful germs carried on your hands.
2 BEFORE CLEAN/ASEPTIC PROCEDURE	WHEN? Clean your hands immediately before performing a clean/aseptic procedure. WHY? To protect the patient against harmful germs, including the patient's own, from entering his/her body.
3 AFTER BODY FLUID EXPOSURE RISK	WHEN? Clean your hands immediately after an exposure risk to body fluids (and after glove removal). WHY? To protect yourself and the health-care environment from harmful patient germs.
4 AFTER TOUCHING A PATIENT	WHEN? Clean your hands after touching a patient and her/his immediate surroundings, when leaving the patient's side. WHY? To protect yourself and the health-care environment from harmful patient germs.
5 AFTER TOUCHING PATIENT SURROUNDINGS	WHEN? Clean your hands after touching any object or furniture in the patient's immediate surroundings, when leaving – even if the patient has not been touched. WHY? To protect yourself and the health-care environment from harmful patient germs.

Five Moments of Hand Hygiene Expanded

When performing hand hygiene, washing with soap and water, or an approved alcohol-based hand rub solution that contains at least 60% alcohol, may be used. Unless hands are visibly soiled, an alcohol-based hand rub is preferred over soap and water in most clinical situations due to evidence of improved compliance. Hand rubs are also preferred because they are generally less irritating to health care worker's hands. However, it is important to recognize that alcohol-based rubs do not eliminate some types of germs, such as *Clostridium difficile* (C-diff).

When using the alcohol-based handrub method, the CDC recommends the following steps. See picture below for a poster created by the World Health Organization.

- Apply product to the palm of one hand in an amount that will cover all surfaces.
- Rub hands together, covering all the surfaces of the hands, fingers, and wrists until the hands are dry. Surfaces include the palms and fingers, between the fingers, the backs of the hands and fingers, the fingertips, and the thumbs.
- The process should take about 20 seconds, and the solution should be dry.

How to Handrub?

RUB HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED

Duration of the entire procedure: 20-30 seconds



WHO Handrub Poster

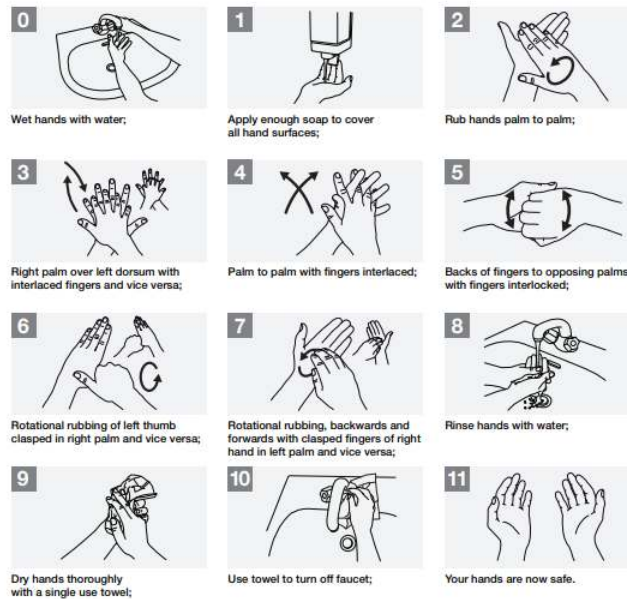
When washing with soap and water, the CDC recommends using the following steps. See picture below of a handwashing poster created by the World Health Organization.

- Wet hands with warm or cold running water and apply facility-approved soap.
- Lather hands by rubbing them together with the soap. Use the same technique as the handrub process to clean the palms and fingers, between the fingers, the backs of the hands and fingers, the fingertips, and the thumbs.
- Scrub thoroughly for at least 20 seconds.
- Rinse hands well under clean, running water.
- Dry the hands using a clean towel or disposable toweling.
- Use a clean paper towel to shut off the faucet.

How to Handwash?

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

⌚ Duration of the entire procedure: 40-60 seconds



WHO Handwashing Poster

By performing hand hygiene at the proper moments and using appropriate techniques, you will ensure your hands are safe and you are not transmitting infectious organisms to yourself or others.

Center for Disease Control & Prevention Links:

Hand Hygiene in Healthcare Settings

Click on this link: Healthcare Providers and look for the topics below:

- Introduction to Hand Hygiene
- When and How to Perform Hand Hygiene
- Glove Use
- Hand Hygiene for Surgery
- Skin and Nail Care

The 4 E's of an Effective Hand Hygiene Program

1. [Engage](#) (Video 5:44)
2. [Educate](#) (Video 5:05)
3. [Execute](#) (Video 4:27)
4. [Evaluate](#) (Video 4:27)

This page titled [Hand Hygiene](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Respiratory Hygiene

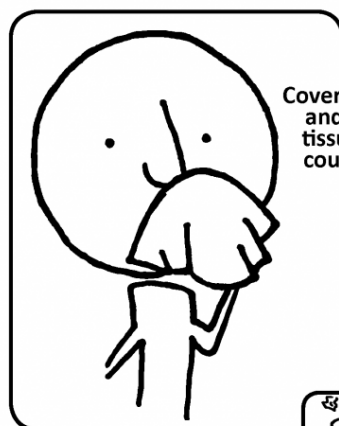
Respiratory hygiene is targeted at patients, accompanying family members and friends, and health care workers with undiagnosed transmissible respiratory infections. It applies to any person with signs of illness, including cough, congestion, rhinorrhea, or increased production of respiratory secretions when entering a health care facility. See picture on the right for an example of a “Cover Your Cough” poster used in public areas to promote respiratory hygiene. The elements of respiratory hygiene include the following:

- Education of health care facility staff, patients, and visitors
- Posted signs, in language(s) appropriate to the population served, with instructions to patients 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 3 feet, of persons with respiratory infections in common waiting areas when possible.

Health care personnel are advised to wear a mask and use frequent hand hygiene when examining and caring for patients with signs and symptoms of a respiratory infection. Health care personnel who have a respiratory infection are advised to avoid direct patient contact, especially with high-risk patients. If this is not possible, then a mask should be worn while providing patient care.

Stop the spread of germs that make you and others sick!

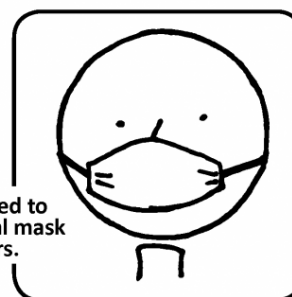
Cover your Cough



Cover your mouth
and nose with a
tissue when you
cough or sneeze

or
cough or sneeze into
your upper sleeve,
not your hands

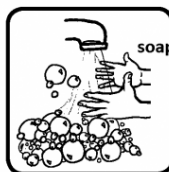
Put your used tissue in
the waste basket.



You may be asked to
put on a surgical mask
to protect others.

Clean your Hands

after coughing or sneezing.



Wash with
soap and water

or
clean with
alcohol-based
hand sanitizer.



m DEPARTMENT
OF HEALTH

Infectious Disease Epidemiology, Prevention and Control
PO Box 64975, St. Paul, MN 55164
651-201-5414 or 1-877-676-5414
www.health.state.mn.us

APIC
ASSOCIATION FOR PROFESSIONALS IN
HEALTH CARE, AND ENVIRONMENT, INC.

3/2020

This page titled [Respiratory Hygiene](#) is shared under a [Public Domain](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) includes gloves, gowns, face shields, goggles, and masks used to prevent the spread of infection to and from patients and health care providers. Depending on the anticipated exposure, PPE may include the use of gloves, a fluid-resistant gown, goggles or a face shield, and a mask or respirator. When used for a patient with transmission-based precautions, PPE supplies are typically stored in an isolation cart next to the patient's room, and a card is posted on the door alerting staff and visitors to precautions needed before entering the room.

Gloves

Gloves protect both patients and health care personnel from exposure to infectious material that may be carried on the hands. Gloves are used to prevent contamination of health care personnel hands during activities such as the following:

- anticipating direct contact with blood or body fluids, mucous membranes, nonintact skin, and other potentially infectious material
- having direct contact with patients who are colonized or infected with pathogens transmitted by the contact route, such as Vancomycin-resistant enterococci (VRE), Methicillin-resistant *Staphylococcus aureus* (MRSA), and Respiratory Syncytial Virus (RSV)
- handling or touching visibly or potentially contaminated patient care equipment and environmental surfaces

Nonsterile disposable medical gloves for routine patient care are made of a variety of materials, such as latex, vinyl, and nitrile. Many people are allergic to latex, so be sure to check for latex allergies for the patient and other health care professionals. At times, gloves may need to be changed when providing care to a single patient to prevent cross-contamination of body sites. It is also necessary to change gloves if the patient interaction requires touching portable computer keyboards or other mobile equipment that is transported from room to room. Discarding gloves between patients is necessary to prevent transmission of infectious material. Gloves must not be washed for subsequent reuse because microorganisms cannot be reliably removed from glove surfaces and continued glove integrity cannot be ensured.

When gloves are worn in combination with other PPE, they are put on last. Gloves that fit snugly around the wrist should be used in combination with isolation gowns because they will cover the gown cuff and provide a more reliable continuous barrier for the arms, wrists, and hands.

Gloves should be removed properly to prevent contamination. See picture below for an illustration of properly removing gloves. Hand hygiene should be performed following glove removal to ensure the hands will not carry potentially infectious material that might have penetrated through unrecognized tears or contaminated the hands during glove removal. One method for properly removing gloves includes the following steps:

- Grasp the outside of one glove near the wrist. Do not touch your skin.
- Peel the glove away from your body, pulling it inside out.
- Hold the removed glove in your gloved hand.
- Put your fingers inside the glove at the top of your wrist and peel off the second glove.
- Turn the second glove inside out while pulling it away from your body, leaving the first glove inside the second.
- Dispose of the gloves safely. Do not reuse.
- Perform hand hygiene immediately after removing the gloves.

How to Remove Gloves

To protect yourself, use the following steps to take off gloves



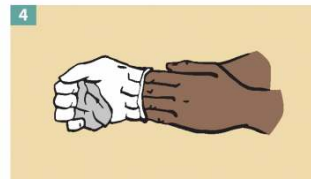
Grasp the outside of one glove at the wrist.
Do not touch your bare skin.



Peel the glove away from your body,
pulling it inside out.



Hold the glove you just removed in
your gloved hand.



Peel off the second glove by putting your fingers
inside the glove at the top of your wrist.



Turn the second glove inside out while pulling
it away from your body, leaving the first glove
inside the second.



Dispose of the gloves safely. Do not reuse the gloves.



Clean your hands immediately after removing gloves.

Adapted from Workers' Compensation Board of B.C.

CS 254759-A

Proper Removal of Gloves to Prevent Contamination

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 healthcare provider may don gloves to suction a patient but neglect to remove them and perform hand hygiene before performing the next procedure on the same patient. This can potentially cause the spread of 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. Health care providers may 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 patient care, there is cross contamination.

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 the picture below for an image of contact dermatitis from gloves. Because the skin is the first line of defense in preventing pathogens from entering the body, maintaining intact skin is very important to prevent exposure to pathogens.



Contact Dermatitis

Gowns

Isolation gowns are used to protect the health care worker's arms and exposed body areas and to prevent contamination of their clothing with blood, body fluids, and other potentially infectious material. Isolation gowns may be disposable or washable/reusable. When using standard precautions, an isolation gown is worn only if contact with blood or body fluid is anticipated. However, when contact transmission-based precautions are in place, donning of both gown and gloves upon room entry is indicated to prevent unintentional contact of clothing with contaminated environmental surfaces.

Gowns are usually the first piece of PPE to be donned. Isolation gowns should be removed before leaving the patient room to prevent possible contamination of the environment outside the patient's room. Isolation gowns should be removed in a manner that prevents contamination of clothing or skin. The outer, "contaminated," side of the gown is turned inward and rolled into a bundle, and then it is discarded into a designated container to contain contamination. See more information about putting on and removing PPE in the subsection below.

Masks

Masks may be used in combination with goggles or a face shield to provide more complete protection for the face. Masks should not be confused with respirators used during airborne transmission-based precautions to prevent inhalation of small, aerosolized infectious droplets.

It is important to properly wear and remove masks to avoid contamination. See picture below for CDC face mask recommendations for health care personnel.

Facemask Do's and Don'ts

For Healthcare Personnel

When putting on a facemask

Clean your hands and put on your facemask so it fully covers your mouth and nose.



DO secure the elastic bands around your ears.



DO secure the ties at the middle of your head and the base of your head.

When wearing a facemask, don't do the following:



DON'T wear your facemask under your nose or mouth.



DON'T allow a strap to hang down. DON'T cross the straps.



DON'T touch or adjust your facemask without cleaning your hands before and after.



DON'T wear your facemask on your head.



DON'T wear your facemask around your neck.



DON'T wear your facemask around your arm.

When removing a facemask

Clean your hands and remove your facemask touching only the straps or ties.



DO leave the patient care area, then clean your hands with alcohol-based hand sanitizer or soap and water.



DO remove your facemask touching ONLY the straps or ties, throw it away*, and clean your hands again.

*If implementing limited-reuse: Facemasks should be carefully folded so that the outer surface is held inward and against itself to reduce contact with the outer surface during storage. Folded facemasks can be stored between uses in a clean, sealable paper bag or breathable container.

Additional information is available about how to safely put on and remove personal protective equipment, including facemasks:

<https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html>.



(5/14/20) 149658

[cdc.gov/coronavirus](https://www.cdc.gov/coronavirus)

Goggles/Face Shields

Eye protection chosen for specific work situations (e.g., goggles or face shields) depends upon the circumstances of exposure, other PPE used, and personal vision needs. **Personal eyeglasses are not considered adequate eye protection.**

Respirators and PAPRs

Respiratory protection used during airborne transmission precautions requires the use of special equipment. Traditionally, a fitted respirator mask with N95 or higher filtration has been worn by health care professionals to prevent inhalation of small airborne infectious particles. A user-seal check (formerly called a “fit check”) should be performed by the wearer of a respirator each time a respirator is donned to minimize air leakage around the facepiece.

A newer piece of equipment used for respiratory protection is the powered air-purifying respirator (PAPR). A PAPR is an air-purifying respirator that uses a blower to force air through filter cartridges or canisters into the breathing zone of the wearer. This process creates an air flow inside either a tight-fitting facepiece or loose-fitting hood or helmet, providing a higher level of protection against aerosolized pathogens, such as COVID-19, than a N95 respirator.

The CDC currently recommends N95 or higher level respirators for personnel exposed to patients with suspected or confirmed tuberculosis and other airborne diseases, especially during aerosol-generating procedures such as respiratory-tract suctioning. It is important to apply, wear, and remove respirators appropriately to avoid contamination. See below for CDC recommendations when wearing disposable respirators.

Respirator On / Respirator Off

When you put on a disposable respirator

Position your respirator correctly and check the seal to protect yourself from COVID-19.



Cup the respirator in your hand. Hold the respirator under your chin with the nose piece up. The top strap (on single or double strap respirators) goes over and rests at the top back of your head. The bottom strap is positioned around the neck and below the ears.



Place your fingertips from both hands at the top of the metal nose clip (if present). Slide fingertips down both sides of the metal strip to mold the nose area to the shape of your nose.



Place both hands over the respirator, take a quick breath in to check the seal. Breathe out. If you feel a leak when breathing in or breathing out, there is not a proper seal.



Select other PPE items that do not interfere with the fit or performance of your respirator.



Do not use a respirator that appears damaged or deformed, no longer forms an effective seal to the face, becomes wet or visibly dirty, or if breathing becomes difficult.



Do not allow facial hair, jewelry, glasses, clothing, or anything else to prevent proper placement or to come between your face and the respirator.



Do not crisscross the straps.



Do not wear a respirator that does not have a proper seal. If air leaks in or out, ask for help or try a different size or model.

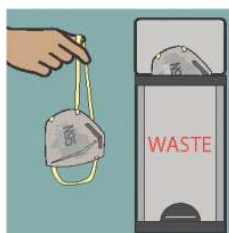


Do not touch the front of the respirator during or after use! It may be contaminated.

When you take off a disposable respirator



Remove by pulling the bottom strap over back of head, followed by the top strap, without touching the respirator.



Discard in a waste container.



Clean your hands with alcohol-based hand sanitizer or soap and water.

Employers must comply with the OSHA Respiratory Protection Standard, 29 CFR 1910.134, which includes medical evaluations, training, and fit testing.

Additional information is available about how to safely put on and remove personal protective equipment, including respirators:
<https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html>



CS 317033A June 9, 2020 3:07 PM

cdc.gov/coronavirus

How to Put On (Don) PPE Gear

The mucous membranes of the mouth, nose, and eyes are susceptible portals of entry for infectious agents. Masks are used to protect these sites from entry of large infectious droplets. Masks have three primary purposes in health care settings:

- Used by health care personnel to protect them from contact with infectious material from patients (e.g., respiratory secretions and sprays of blood or body fluids), consistent with standard precautions and droplet transmission precautions
- Used by health care personnel when engaged in procedures requiring sterile technique to protect patients from exposure to infectious agents potentially carried in a health care worker's mouth or nose.
- Placed on coughing patients to limit potential dissemination of infectious respiratory secretions from the patient to others in public areas (i.e., respiratory hygiene)

Follow agency policy for donning PPE according to transmission-based precautions. More than one donning method for putting on PPE may be acceptable. The CDC recommends the following steps for donning PPE:

- Identify and gather the proper PPE to don. Ensure the gown size is correct.
- Perform hand hygiene using hand sanitizer or wash hands with soap and water.
- Put on the isolation gown. Tie all of the ties on the gown. Assistance may be needed by other health care personnel to tie back ties.
- Based on specific transmission-based precautions and agency policy, put on a mask or N95 respirator. The top strap should be placed on the crown (top) of the head, and the bottom strap should be at the base of the neck. If the mask has loops, hook them appropriately around your ears. Masks and respirators should extend under the chin, and both your mouth and nose should be protected. Perform a user-seal check each time you put on a respirator. If the respirator has a nosepiece, it should be fitted to the nose with both hands, but it should not be bent or tented. Masks typically require the nosepiece to be pinched to fit around the nose, but do not pinch the nosepiece of a respirator with one hand. Do not wear a respirator or mask under your chin or store it in the pocket of your scrubs between patients.
- Put on a face shield or goggles when indicated. When wearing an N95 respirator with eye protection, select eye protection that does not affect the fit or seal of the respirator and one that does not affect the position of the respirator. Goggles provide excellent protection for the eyes, but fogging is common. Face shields provide full-face coverage.
- Put on gloves. Gloves should cover the cuff (wrist) of the gown.
- You may now enter the patient's room.

CDC Links for Donning/Doffing PPE:

- Poster: Sequence for Donning/Removing PPE
- Donning PPE: Introduction
- Doffing PPE: Prepare to Doff Your PPE

This page titled [Personal Protective Equipment \(PPE\)](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Environmental Measures

Routine cleaning and disinfecting surfaces in patient-care areas are part of standard precautions. The cleaning and disinfecting of all patient-care areas are important for frequently touched surfaces, especially those closest to the patient that are most likely to be contaminated (e.g., bedrails, bedside tables, commodes, doorknobs, sinks, surfaces, and equipment in close proximity to the patient).

Medical equipment and instruments/devices must also be cleaned to prevent patient-to-patient transmission of infectious agents. For example, stethoscopes should be cleaned before and after use for all patients. Patients who have transmission-based precautions should have dedicated medical equipment that remains in their room (e.g., stethoscope, blood pressure cuff, thermometer). When dedicated equipment is not possible, such as a unit-wide bedside blood glucose monitor, disinfection after each patient's use should be performed according to agency policy.

Disposal of Contaminated Waste

Medical waste requires careful disposal according to agency policy. The Occupational Safety and Health Administration (OSHA) has established measures for discarding regulated medical waste items to protect the workers who generate medical waste, as well as those who manage the waste from point of generation to disposal. Contaminated waste is placed in a leak-resistant biohazard bag, securely closed, and placed in a labeled, leakproof, puncture-resistant container in a storage area. Sharps containers are used to dispose of sharp items such as discarded tubes with small amounts of blood, scalpel blades, needles, and syringes.

Sharps Safety

Injuries due to needles and other sharps have been associated with transmission of blood-borne pathogens (BBP), including hepatitis B, hepatitis C, and HIV to health care personnel. The prevention of sharps injuries is an essential element of standard precautions and includes measures to handle needles and other sharp devices in a manner that will prevent injury to the user and to others who may encounter the device during or after a procedure. The Bloodborne Pathogens Standard is a regulation that prescribes safeguards to protect workers against health hazards related to blood-borne pathogens. It includes work practice controls, hepatitis B vaccinations, hazard communication and training, plans for when an employee is exposed to a BBP, and record keeping.

When performing procedures that include needles or other sharps, dispose of these items immediately in FDA-cleared sharps disposal containers. Additionally, to prevent needlestick injuries, needles and other contaminated sharps should not be recapped. See picture to the right for an image of a sharps disposal container. FDA-cleared sharps disposal containers are made from rigid plastic and come marked with a line that indicates when the container should be considered full, which means it's time to dispose of the container. When a sharps disposal container is about three-quarters full, follow agency policy for proper disposal of the container.

Sharps Disposal Containers

If you are stuck by a needle or other sharps or are exposed to blood or other potentially infectious materials in your eyes, nose, mouth, or on broken skin, immediately flood the exposed area with water and clean any wound with soap and water. Report the incident immediately to your instructor or employer and seek immediate medical attention according to agency and school policy.



Textiles and Laundry

Soiled textiles, including bedding, towels, and patient or resident clothing may be contaminated with pathogenic microorganisms. However, the risk of disease transmission is negligible if they are handled, transported, and laundered in a safe manner. Follow agency policy for handling soiled laundry using standard precautions. Key principles for handling soiled laundry are as follows:

- Do not shake items or handle them in any way that may aerosolize infectious agents.
- Avoid contact of one's body and personal clothing with the soiled items being handled.
- Place soiled items in a laundry bag or designated bin in the patient's room before transporting to a laundry area. When laundry chutes are used, they must be maintained to minimize dispersion of aerosols from contaminated items.

This page titled [Environmental Measures](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Aseptic Technique

In addition to using standard precautions and transmission-based precautions, aseptic technique (also called medical asepsis) is 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 healthcare professional administering parenteral medication or performing urinary catheterization uses aseptic technique. When performed properly, aseptic technique prevents contamination and transfer of pathogens to the patient from caregiver hands, surfaces, and equipment during routine care or procedures. The word “aseptic” literally means an absence of disease-causing microbes and pathogens. In the clinical setting, aseptic technique refers to the purposeful prevention of microbe contamination from one person or object to another. These potentially infectious, microscopic organisms can be present in the environment, on an instrument, in liquids, on skin surfaces, or within a wound.

There is often misunderstanding between the terms aseptic technique and sterile technique in the health care setting. Both asepsis and sterility are closely related, and the shared concept between the two terms is removal of harmful microorganisms that can cause infection. In the most simplistic terms, asepsis is creating a protective barrier from 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. 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, creation of a sterile field, using long-lasting antimicrobial cleansing agents such as betadine, donning sterile gloves, and using sterile devices and instruments.

Principles of Aseptic Non-Touch Technique

Aseptic non-touch technique (ANTT) is the most commonly used aseptic technique framework in the health care setting and is considered a global standard. There are two types of ANTT: surgical-ANTT (sterile technique) and standard-ANTT.

Aseptic non-touch technique starts with a few concepts that must be understood before it can be applied. For all invasive procedures, the “ANTT-approach” identifies key parts and key sites throughout the preparation and implementation of the procedure. A key part is any sterile part of equipment used during an aseptic procedure, such as needle hubs, syringe tips, needles, and dressings. A key site is any nonintact skin, potential insertion site, or access site used for medical devices connected to the patients. Examples of key sites include open wounds and insertion sites for intravenous (IV) devices and urinary catheters.

ANTT includes four underlying principles to keep in mind while performing invasive procedures:

- Always wash hands effectively.
- Never contaminate key parts.
- Touch non-key parts with confidence.
- Take appropriate infective precautions.

Preparing and Preventing Infections Using Aseptic Technique

When planning for any procedure, careful thought and preparation of many infection control factors must be considered beforehand. While keeping standard precautions in mind, identify anticipated key sites and key parts to the procedure. Consider the degree to which the environment must be managed to reduce the risk of infection, including the expected degree of contamination and hazardous exposure to the clinician. Finally, review the expected equipment needed to perform the procedure and the level of key part or key site handling. See the table to the right for an outline of infection control measures when performing a procedure.

Use of Gloves and Sterile Gloves

There are two different levels of medical-grade gloves available to health care providers: clean (exam) gloves and sterile (surgical) gloves. Generally speaking, clean gloves are used whenever there is a risk of contact with body fluids or contaminated surfaces or objects. Examples include starting an intravenous access device or emptying a urinary catheter collection bag. Alternatively, sterile gloves meet FDA requirements for sterilization and are used for invasive procedures or when contact with a sterile site, tissue, or body cavity is anticipated. Sterile gloves are used in these instances to prevent transient flora and reduce resident flora contamination during a procedure, thus preventing the introduction of pathogens. For example, sterile gloves are required when performing central line dressing changes, insertion of urinary catheters, and during invasive surgical procedures.

Infection Control Measures When Performing Procedures

Infection Control Measure	Key Considerations	Examples
Environmental control	Recognize and avoid risks in the environment that may increase risk of infection.	• Ensure clean bed linens. • Monitor patient lines that are near or across work areas. • Clean surfaces before establishing a work area. • Keep food and personal items away from working areas.
Hand hygiene	Perform hand hygiene frequently and during key moments.	• Scrub with soap solution and water for 20-30 seconds. • Use alcohol-based rub until dry, unless hands are visibly soiled or the patient has C-diff.
Personal protective equipment (PPE)	• Select sterile or clean gloves based on the need to touch key parts or key sites directly. • Gloves do not replace the need for hand hygiene.	• Gloves (sterile or clean, based on the procedure) • Mask or respirator • Protective eyewear, goggles, or face shield • Gown (sterile or clean, whichever is appropriate)
Aseptic field management	Determine level of aseptic field needed and how it will be managed before the procedure begins: • General aseptic field: Key parts and sites are easily protected. Sterile field does not need to be set up and managed as a key part. • Critical aseptic field: Key parts and sites are large, numerous, or not easily protected using non-touch technique. Sterile field needs to be established before and managed during procedure.	General aseptic field: • IV irrigation • Dry dressing changes Critical aseptic field: • Central line dressing change • Sterile dressing change
Non-touch technique	• Non-touch is the primary goal, even when sterile gloves are used. • Requires preparation and knowledge of planned procedure sequencing. • Touching key sites and key parts is limited, purposeful, and only when needed.	• Handling key parts only at the time needed to assemble or use in procedure • Handling syringes away from the hub • Applying bandages by the edges away from key parts that will contact key sites
Sequencing	• Order of procedure requires planning to be efficient, logical, and safe. • Practicing guidelines give direction as to optimal order from preparation to completion.	Generally, follow “clean to dirty” standards, working from least to most contaminated key parts and sites.

This page titled [Aseptic Technique](#) is shared under a [Public Domain](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Providing Patient 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 symptoms and signs 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 101°F (38.3°C) or higher is considered a fever**. 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 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 patients 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.

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 confusion and/or worsening level of consciousness.
Wound or Incision	Progressive healing of a wound with no signs of infection	New redness, warmth, tenderness, or purulent drainage from a wound.
Respiratory	No cough or production of sputum	New cough and/or productive cough of purulent sputum. Adventitious breath sounds (crackles, rhonchi, wheezing). New 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.

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.

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. The most common infections in older adults are urinary tract infections (UTI), bacterial pneumonia, influenza, and skin infections.

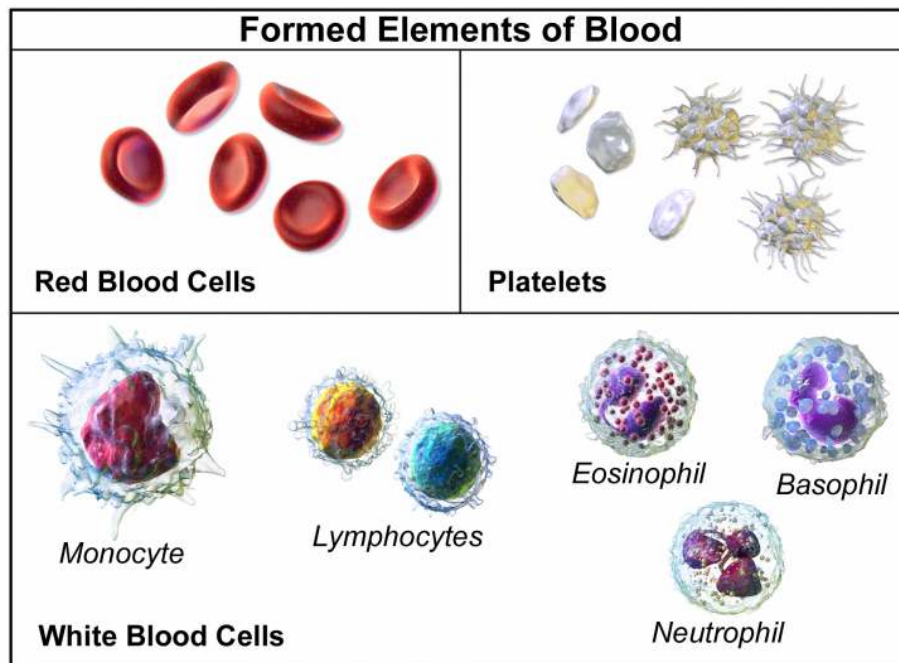
Diagnostic Tests

Several types of diagnostic tests may be ordered by a health care provider when a patient 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 below for a picture of a complete blood count with differential.



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 $4.5\text{-}11.0 \times 10^9$ per liter (L).[5]

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.

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

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.

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.

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

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.

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 cause 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.

LACTATE

Serum lactate levels are measured when sepsis is suspected in a patient 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.

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, heart attack, heart failure, or respiratory distress.

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.

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 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.

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. The nurse must be aware of these orders because they impact the timing of administration of antibiotics.

This page titled [Providing Patient Care](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Initiating Patient Interaction

Before every patient interaction, the medical assistant must perform hand hygiene and consider the use of additional personal protective equipment, introduce themselves, and identify the patient using two different identifiers. It is also important to provide a culturally safe space for interaction and to consider the developmental stage of the patient.



Introducing Oneself

When initiating care with patients, it is essential to first provide privacy, and then introduce yourself and explain what will be occurring. Providing privacy means taking actions such as talking with the patient privately in a room with the door shut. A common framework used to communicate with patients is AIDET, a mnemonic for Acknowledge, Introduce, Duration, Explanation, and Thank You.

- **Acknowledge:** Greet the patient by the name documented in their medical record. Make eye contact, smile, and acknowledge any family or friends in the room. Ask the patient their preferred way of being addressed (for example, “Mr. Doe,” “Jonathon,” or “Johnny”) and their preferred pronouns (i.e., he/him, she/her or they/them), as appropriate.
- **Introduce:** Introduce yourself by your name and role. For example, “I’m John Doe and I am the medical assistant working with your provider to take care of you today.”
- **Duration:** Estimate a timeline for how long it will take to complete the task you are doing. For example, “I am here to obtain your blood pressure, heart rate, and oxygen saturation levels. This should take about 5 minutes.”
- **Explanation:** Explain step by step what to expect next and answer questions. For example, “I will be putting this blood pressure cuff on your arm and inflating it. It will feel as if it is squeezing your arm for a few moments.”
- **Thank You:** At the end of the encounter, thank the patient and ask if anything is needed before you leave.

Patient Identification

Use at least two patient identifiers before performing assessments, obtaining vital signs or providing care. **Ask the patient to state their name and date of birth.**

Cultural Safety

When initiating patient interaction, it is important to establish cultural safety. Recognizing that you and all patients bring a cultural context to interactions in a health care setting is helpful when creating cultural safe spaces. If you discover you need more

information about a patient's cultural beliefs to tailor your care, use an open-ended question that allows the patient to share what they believe to be important. For example, you may ask, "I am interested in your cultural background as it relates to your health. Can you share with me what is important about your cultural background that will help me care for you?"

Adapting to Variations Across the Life Span

It is important to adapt your interactions with patients in accordance with their developmental stage. Developmentalists break the life span into nine stages:

- Prenatal Development
- Infancy and Toddlerhood
- Early Childhood
- Middle Childhood
- Adolescence
- Early Adulthood
- Middle Adulthood
- Late Adulthood
- Death and Dying

When caring for infants, toddlers, children, and adolescents, parents or guardians are an important source of information, and family dynamics should be included as part of the general survey assessment. When caring for older adults or those who are dying, other family members may be important to include in the general survey assessment.

See below for a brief overview of the characteristics of each stage of human development.

Variations Across the Life Span

Stage of Development	Common Characteristics
Prenatal Development	Conception occurs and development begins. All major structures of the body are forming and the health of the mother is of primary concern. Understanding nutrition, teratogens (environmental factors that can lead to birth defects), and labor and delivery are primary concerns for the mother.
Infancy and Toddlerhood	The first year and a half to two years of life are ones of dramatic growth and change. A newborn with a keen sense of hearing but very poor vision is transformed into a walking, talking toddler within a relatively short period of time. Caregivers are also transformed from someone who manages feeding and sleep schedules to a constantly moving guide and safety inspector for a mobile, energetic child.
Early Childhood	Early childhood is also referred to as the preschool years, consisting of the years that follow toddlerhood and precede formal schooling. As a three- to five-year-old, the child is busy learning language, gaining a sense of self and greater independence, and beginning to learn the workings of the physical world. This knowledge does not come quickly however, and preschoolers may have initially interesting conceptions of size, time, space, and distance, such as fearing that they may go down the drain if they sit at the front of the bathtub. A toddler's fierce determination to do something may give way to a four-year-old's sense of guilt for doing something that brings the disapproval of others.
Middle Childhood	The ages of six through eleven comprise middle childhood, and much of what children experience at this age is connected to their involvement in the early grades of school. Their world becomes filled with learning and testing new academic skills, assessing one's abilities and accomplishments, and making comparisons between self and others. Schools compare students and make these comparisons public through team sports, test scores, and other forms of recognition. Growth rates slow down and children are able to refine their motor skills at this point in life. Children begin to learn about social relationships beyond the family through interaction with friends and fellow students.
Adolescence	The World Health Organization defines adolescence as a person between the age of 10 and 19. Adolescence is a period of dramatic physical change marked by an overall physical growth spurt and sexual maturation, known as puberty. It is also a time of cognitive change as the adolescent begins to think of new possibilities and to consider abstract concepts such as love, fear, and freedom. Adolescents have a sense of invincibility that puts them at greater risk of injury from high-risk behaviors such as car accidents, drug and alcohol abuse, or contracting sexually transmitted infections that can have lifelong consequences or result in death.
Early Adulthood	The twenties and thirties are often thought of as early adulthood. It is a time of physiological peak but also highest risk for involvement in violent crimes and substance abuse. It is a time of focusing on the future and putting a lot of energy into making

Stage of Development	Common Characteristics
	choices that will help one earn the status of a full adult in the eyes of others. Love and work are primary concerns at this stage of life.
Middle Adulthood	The late thirties through the mid-sixties is referred to as middle adulthood. This is a period in which aging processes that began earlier become more noticeable but also a time when many people are at their peak of productivity in love and work. It can also be a time of becoming more realistic about possibilities in life previously considered and of recognizing the difference between what is possible and what is likely to be achieved in their lifetime.
Late Adulthood	This period of the life span has increased over the last 100 years. For nurses, patients in this period are referred to as “older adults.” The term “young old” is used to describe people between 65 and 79, and the term “old old” is used for those who are 80 and older. One of the primary differences between these groups is that the young old are very similar to midlife adults because they are still working, still relatively healthy, and still interested in being productive and active. The “old old” may remain productive, active, and independent, but risks of heart disease, lung disease, cancer, and cerebral vascular disease (i.e., strokes) increase substantially for this age group. Issues of housing, health care, and extending active life expectancy are only a few of the topics of concern for this age group. A better way to appreciate the diversity of people in late adulthood is to go beyond chronological age and examine whether a person is experiencing optimal aging (when they are in very good health for their age and continue to have an active, stimulating life), normal aging (when the changes in health are similar to most of those of the same age), or impaired aging (when more physical challenges and diseases occur compared to others of the same age).
Death and Dying	Death is the final stage of life. Dying with dignity allows an individual to make choices about treatment, say goodbyes, and take care of final arrangements. When caring for patients who are actively dying, nurses can advocate for care that allows that person to die with dignity according to their wishes.

This page titled [Initiating Patient Interaction](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Blood Pressure

The accurate measurement of blood pressure is important for ensuring patient safety and optimizing body system function. Blood pressure measurements are used by health care providers to make important decisions about a patient's care. . It is crucial to follow the proper steps to obtain a patient's blood pressure to ensure the provider has accurate data to help make health care decisions and determine a plan of care.

What is Blood Pressure?

A blood pressure reading is the measurement of the force of blood against the walls of the arteries as the heart pumps blood through the body. It is reported in millimeters of mercury (mmHg). This pressure changes in the arteries when the heart is contracting compared to when it is resting and filling with blood. Blood pressure is typically expressed as the reflection of two numbers, systolic pressure and diastolic pressure. The **systolic blood pressure** is the maximum pressure on the arteries during systole, the phase of the heartbeat when the ventricles contract. **Systole** causes the ejection of blood out of the ventricles and into the aorta and pulmonary arteries. The **diastolic blood pressure** is the resting pressure on the arteries during diastole, the phase between each contraction of the heart when the ventricles are filling with blood.

Blood pressure measurements are obtained using a stethoscope and a **sphygmomanometer**, also called a blood pressure cuff. To obtain a manual blood pressure reading, the blood pressure cuff is placed around a patient's extremity, and a stethoscope is placed over an artery. For most blood pressure readings, the cuff is usually placed around the upper arm, and the stethoscope is placed over the brachial artery. The cuff is inflated to constrict the artery until the pulse is no longer palpable, and then it is deflated slowly. The American Heart Association (AHA) recommends that the blood pressure cuff be inflated at least 30 mmHg above the point at which the radial pulse is no longer palpable. The first appearance of sounds, called **Korotkoff sounds**, are noted as the systolic blood pressure reading. Korotkoff sounds are named after Dr. Korotkoff, who first discovered the audible sounds of blood pressure when the arm is constricted. The blood pressure cuff continues to be deflated until Korotkoff sounds disappear. The last Korotkoff sounds reflect the diastolic blood pressure reading. It is important to deflate the cuff slowly at no more than 2-3 mmHg per second to ensure that the absence of pulse is noted promptly and that the reading is accurate. Blood pressure readings are documented as systolic blood pressure/diastolic pressure, for example, 120/80 mmHg.

To hear the Korotkoff sounds, click the following link: [YouTube Video: Korotkoff Sounds Annotated Video \(Hayden Allbutt 2:33 min\)](#)

Abnormal blood pressure readings can signify an area of concern and a need for intervention. Normal adult blood pressure is less than 120/80 mmHg. **Hypertension** is the medical term for elevated blood pressure readings of 130/80 mmHg or higher. See Table 4.2 for blood pressure categories according to the 2017 American College of Cardiology and American Heart Association Blood Pressure Guidelines. Prior to diagnosing a person with hypertension, the health care provider will calculate an average blood pressure based on two or more blood pressure readings obtained on two or more occasions.

Hypotension is the medical term for low blood pressure readings less than 90/60 mmHg. Hypotension can be caused by dehydration, bleeding, cardiac conditions, and the side effects of many medications. Hypotension can be of significant concern because of the potential lack of perfusion to critical organs when blood pressures are low. **Orthostatic hypotension** is a drop in blood pressure that occurs when moving from a lying down (supine) or seated position to a standing (upright) position. When measuring blood pressure, orthostatic hypotension is defined as a decrease in blood pressure by at least 20 mmHg systolic or 10 mmHg diastolic within three minutes of standing. When a person stands, gravity moves blood from the upper body to the lower limbs. As a result, there is a temporary reduction in the amount of blood in the upper body for the heart to pump, which decreases blood pressure. Normally, the body quickly counteracts the force of gravity and maintains stable blood pressure and blood flow. In most people, this transient drop in blood pressure goes unnoticed. However, some patients with orthostatic hypotension can experience light-headedness, dizziness, or fainting. This is a significant safety concern because of the increased risk of falls and injury, particularly in older adults. Orthostatic hypotension is also commonly referred to as postural hypotension. When obtaining orthostatic vital signs, the pulse rate may also be collected. If the pulse increases by 30 beats/minute or more while the patient stands (or sits if unable to stand), this indicates a significant change.

Orthostatic Vital Signs Instructions

1. Have the patient stand upright for 1 minute if able
2. Obtain the blood pressure measurement while the patient stands using the same arm and the same equipment as the previous measurement that was taken with patient lying or sitting.
3. Obtain the radial pulse again.
4. Repeat the blood pressure and radial pulse measurements again at 3 minutes. Waiting several minutes before repeating the measurements allows time for the autonomic nervous system to compensate for blood volume shifts after position change in the patient without orthostatic hypotension.
5. If the patient has symptoms that suggest orthostatic hypotension but doesn't have documented orthostatic hypotension, repeat blood pressure measurement.

Equipment to Measure Blood Pressure

Manual Blood Pressure

A sphygmomanometer, commonly called a blood pressure cuff, is used to measure blood pressure while Korotkoff sounds are auscultated using a stethoscope.



Sphygmomanometer

There are various sizes of blood pressure cuffs. It is crucial to select the appropriate size for the patient to obtain an accurate reading. An undersized cuff will cause an artificially high blood pressure reading, and an oversized cuff will produce an artificially low reading.



Sizes of Blood Pressure Cuffs

The width of the cuff should be 40% of the person's arm circumference, and the length of the cuff's bladder should be 80–100% of the person's arm circumference. Keep in mind that only about half of the blood pressure cuff is the bladder and the other half is cloth with a hook and loop fastener to secure it around the arm.

Automatic Blood Pressure Equipment

Automatic blood pressure monitors are often used in health care settings to efficiently measure blood pressure for multiple patients or to repeatedly measure a single patient's blood pressure at a specific frequency such as every 15 minutes.

To use an automatic blood pressure monitor:

1. Appropriately position the patient and place the correctly sized blood pressure cuff on their bare arm or other extremity.
2. Press the start button on the monitor.
3. The cuff will automatically inflate and then deflate at a rate of 2 mmHg per second.
4. The monitor digitally displays the blood pressure reading when done.

If the blood pressure reading is unexpected, it is important to follow up by obtaining a reading using a manual blood pressure cuff. Additionally, automatic blood pressure monitors should not be used if the patient has a rapid or irregular heart rhythm, such as atrial fibrillation, or has tremors as it may lead to an inaccurate reading.

BLOOD PRESSURE ASSESSMENT

Subjective Assessment

Before taking a person's blood pressure, it is important to determine if they have a history of elevated blood pressure or if they are taking any blood pressure medication. It is helpful to establish a baseline by asking their usual blood pressure reading or reviewing previous records in their chart. It is also important to determine if there are any arm restrictions such as those due to a fistula, mastectomy, stroke, or IV line before measuring blood pressure.

Interview Questions for Subjective Assessment of Blood Pressure

- Have you ever been diagnosed with an elevated blood pressure? Please describe the treatment.
- Are you currently taking any medications, herbs, or supplements for your blood pressure? Please identify what you are taking.
- Do you have any restrictions on taking blood pressure in your arms such as those due to a fistula or mastectomy? Please describe the restrictions.
- What is your usual blood pressure reading?
- Do you take your blood pressure at home? What time of day do you take the reading? Where do you obtain the reading from (i.e., cuff location and placement)? What is the range of results that you commonly receive in the home setting?

- If applicable, Are you experiencing any symptoms related to high or low blood pressure now, such as a severe headache, dizziness with position changes, light-headedness, or fainting episodes?

Terms to Know

- **Systolic blood pressure** - The maximum pressure of blood on the arteries during the contraction of the left ventricle of the heart referred to as systole.
- **Systole** - The phase of the heartbeat when the left ventricle contracts and pumps blood into the arteries.
- **Diastolic blood pressure** - The resting pressure of blood on the arteries between each cardiac contraction.
- **Sphygmomanometer** - An instrument for measuring blood pressure typically consisting of an inflatable rubber cuff.
- **Korotkoff sounds** - the audible sounds of blood pressure named after Dr. Korotkoff who discovered them.
- **Hypertension** - Elevated blood pressure over 130/80 mmHg in an adult.
- **Hypotension** - Decreased blood pressure less than 90/60 mmHg in an adult.
- **Orthostatic hypotension** - A decrease in blood pressure by at least 20mmHg systolic or 10mmHg diastolic within three minutes of standing from a seated or lying position.

American Heart Association Resources

- [Understanding Blood Pressure Readings](#)
- [The Facts About High Blood Pressure](#)
- [Top Things to Know: Measurement of Blood Pressure in Humans](#)
- [STEPS FOR ACCURATE BP MEASUREMENT Poster](#)
- [Diagnosing and Managing Hypertension in Adults](#)
- [HCP Hypertension Guideline Toolkit](#)
- [One Size Does Not Fit All: Impact of Using a Regular Cuff for All Blood Pressure Measurements](#)

Click the following link to learn more about blood pressure: [Kahn Academy: Blood Pressure](#)

Life Span Considerations

Children:

Blood pressure measurement is not routinely performed on children under the age of 3 unless there are cardiac concerns.

Older Adults

Blood pressure measurements are sometimes difficult to hear in older adults. For patients who are clinically stable and Korotkoff sound auscultation is difficult, doppler auscultation may be helpful.

Clinical Tips

Blood pressure assessment should be completed after the patient has rested for a minimum of five minutes. If the patient has ingested caffeine or nicotine within 30 minutes before measuring blood pressure, this should be documented with the reading.

There are times when it is difficult to auscultate Korotkoff sounds. As a result, the care team must decide what alternate measures could be performed to obtain accurate blood pressure results. For patients who are critically ill or hemodynamically unstable, an arterial line may be placed directly into an artery to measure blood pressure. This is an invasive procedure and is not used for routine monitoring.

This page titled [Blood Pressure](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

General Survey

Patient data is considered either subjective or objective, and it can be collected from multiple sources.

Subjective Data

Subjective data is information obtained from the patient and/or family members and offers important cues from their perspectives. When documenting subjective data, it should be in quotation marks and start with verbiage such as, “The patient reports...” or “The patient’s wife states...” It is vital for the medical assistant to establish rapport with a patient to obtain accurate data for why the patient is being seen.

Example. An example of documented subjective data obtained from a patient assessment is, “The patient reports pain severity of 2 on a 0-10 scale.”

There are two types of subjective information, primary and secondary. Primary data is information provided directly by the patient. Patients are the best source of information about their bodies and feelings, and the medical assistant who actively listens to a patient will often learn valuable information while also promoting a sense of well-being. Information collected from a family member, chart, or other sources is known as secondary data. Family members can provide important information, especially for infants and children or when the patient is unable to speak for themselves.

Objective Data

Objective data is anything that you can observe through your senses of hearing, sight, smell, and touch while assessing the patient. Objective data is reproducible, meaning another person can easily obtain the same data. Examples of objective data are vital signs, physical examination findings, and laboratory results.

Example. An example of documented objective data is, “The patient’s radial pulse is 58 and regular, and their skin feels warm and dry.”

Sources of Assessment Data

Assessment data is collected in three ways: during a focused interview, during physical examination, or while reviewing laboratory and diagnostic test results.

Interviewing

Interviewing includes asking the patient questions, listening, and observing verbal and nonverbal communication. Reviewing the chart prior to interviewing the patient eliminates redundancy in the interview process and allows the medical assistant to hone in on the most significant areas of concern or need for clarification. However, if information in the chart does not make sense or is incomplete, the medical assistant should use the interview process to verify data with the patient.

When beginning an interview, ask the patient what they are being seen for. Listen carefully and ask for clarification when something isn’t clear to you. Patients may not volunteer important information because they don’t realize it is important for their care. By using critical thinking and active listening, you may discover valuable cues that are important. Sometimes medical assistant students can feel uncomfortable with asking personal questions because of generational or other differences. Don’t shy away from asking questions that are important to know.

Be alert and attentive to how the patient answers questions, as well as when they do not answer a question. Nonverbal communication and body language can be cues to important information that requires further investigation. A keen sense of observation is important, and any concerns should be reported to the provider.

This page titled [General Survey](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Oxygen Saturation

A patient's oxygenation status is routinely assessed using pulse oximetry, referred to as SpO₂. SpO₂ is an estimated oxygenation level based on the saturation of hemoglobin measured by a pulse oximeter. Because the majority of oxygen carried in the blood is attached to hemoglobin within the red blood cells, SpO₂ estimates how much hemoglobin is "saturated" with oxygen. The target range of SpO₂ for an adult is 94-100%. For patients with chronic respiratory conditions, such as chronic obstructive pulmonary disease (COPD), the target range for SpO₂ is often lower at 88% to 92%. Although SpO₂ is an efficient, noninvasive method to assess a patient's oxygenation status, it is an estimate and not always accurate. For example, if a patient is severely anemic and has a decreased level of hemoglobin in the blood, the SpO₂ reading is affected. Decreased peripheral circulation can also cause a misleading low SpO₂ level.

A pulse oximeter includes a sensor that measures light absorption of hemoglobin. The sensor can be attached to the patient using a variety of devices. For intermittent measurement of oxygen saturation, a spring-loaded clip is attached to a patient's finger or toe. However, this clip is too large for use on newborns and young children; therefore, for this population, the sensor is typically taped to a finger or toe. An earlobe clip is another alternative for patients who cannot tolerate the finger or toe clip or have a condition, such as vasoconstriction and poor peripheral perfusion, that could affect the results.



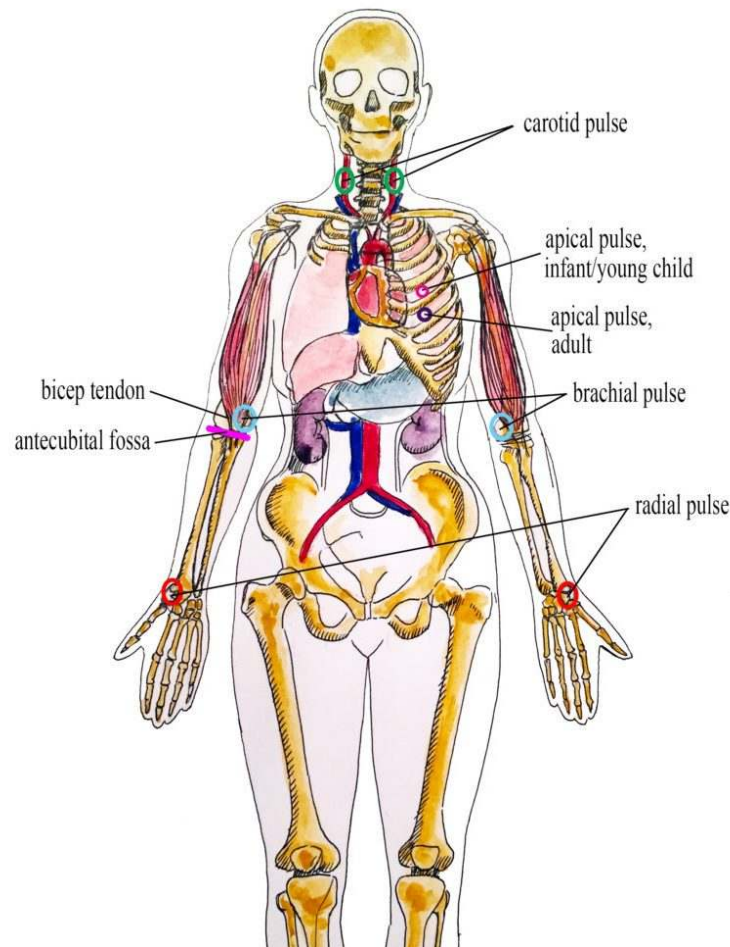
Pulse Oximeter

Nail polish or artificial nails can affect the absorption of light waves from the pulse oximeter and decrease the accuracy of the SpO₂ measurement when using a probe clipped on the finger. An alternative sensor that does not use the finger should be used for these patients or the nail polish should be removed.

This page titled [Oxygen Saturation](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Pulse

Pulse refers to the pressure wave that expands and recoils arteries when the left ventricle of the heart contracts. It is palpated at many points throughout the body. The most common locations to assess pulses as part of vital sign measurement include radial, brachial, carotid, and apical areas as indicated in the picture below.



Common Pulse Assessment Locations

Pulse is measured in beats per minute. The normal adult pulse rate (heart rate) at rest is 60–100 beats per minute with different ranges according to age. The pulse rate is a measurement of the heart rate or the number of times the heart beats per minute. Pulse can be measured wherever a pulse can be palpated whereas a heart rate is auscultated. The pulse rate may differ from the heart rate if the force of the heart contraction is not strong enough to generate a pulse. See Table 1.3b for normal heart rate ranges by age. It is important to consider each patient situation when analyzing if their heart rate is within normal range. Begin by reviewing their documented baseline heart rate. Consider other factors if the pulse is elevated, such as the presence of pain or crying in an infant. It is best to complete the assessment when a patient is resting and comfortable, but if this is not feasible, document the circumstances surrounding the assessment and reassess as needed. For example, pulse rate may be artificially elevated when individuals experience physical or mental stress. Therefore, it is best to collect a pulse rate assessment when the patient is resting.

Normal Heart Rate by Age

Age Group	Heart Rate
Preterm	120 – 180
Newborn (0 to 1 month)	100 – 160
Infant (1 to 12 months)	80 – 140
Toddler (1 to 3 years)	80 – 130
Preschool (3 to 5 years)	80 – 110
School Age (6 to 12 years)	70 – 100
Adolescents (13 to 18 years) & Adults	60 – 100

Pulse Characteristics

When assessing pulses, the characteristics of rhythm, rate, force, and equality are included in the documentation.

PULSE RHYTHM

A normal pulse has a regular rhythm, meaning the frequency of the pulsation felt by your fingers is an even tempo with equal intervals between pulsations. For example, if you compare the palpation of pulses to listening to music, it follows a constant beat at the same tempo that does not speed up or slow down. Some cardiovascular conditions, such as atrial fibrillation, cause an irregular heart rhythm. If a pulse has an irregular rhythm, document if it is “regularly irregular” (e.g., three regular beats are followed by one missed and this pattern is repeated) or if it is “irregularly irregular” (e.g., there is no rhythm to the irregularity).

PULSE RATE

The pulse rate is counted with the first beat felt by your fingers as “One.” It is considered best practice to assess a patient’s pulse for a full 60 seconds, especially if there is an irregularity to the rhythm.

PULSE FORCE

The pulse force is the strength of the pulsation felt on palpation. Pulse force can range from absent to bounding. The volume of blood, the heart’s functioning, and the arteries’ elastic properties affect a person’s pulse force.

Pulse force is documented using a four-point scale:

- 3+: Full, bounding
- 2+: Normal/strong
- 1+: Weak, diminished, thready
- 0: Absent/nonpalpable

Radial Pulse

1. Use the pads of your first three fingers to gently palpate the radial pulse.
2. The pads of the fingers are placed along the radius bone on the lateral side of the wrist (i.e., the thumb side).
3. Fingertips are placed close to the flexor aspect of the wrist (i.e., where the wrist meets the hand and bends).
4. See picture below for correct placement of fingers in obtaining a radial pulse.
5. Press down with your fingers until you can feel the pulsation, but not so forcefully that you are obliterating the wave of the force passing through the artery.
6. Note that radial pulses are difficult to palpate on newborns and children under the age of five, so the brachial or apical pulses are typically obtained in this population.



Radial Pulse

Carotid Pulse

The carotid pulse is typically palpated during medical emergencies because it is the last pulse to disappear when the heart is not pumping an adequate amount of blood.

1. Locate the carotid artery medial to the sternomastoid muscle, between the muscle and the trachea, in the middle third of the neck.
2. In order to palpate the carotid, place the index and middle fingers on the client's neck to the side of individual's trachea.
3. With the pads of your three fingers, gently palpate one carotid artery at a time so as not to compromise blood flow to the brain.
4. See picture below for correct placement of fingers in a seated patient.



Carotid Pulse

Brachial Pulse

A brachial pulse is typically assessed in infants and children because it can be difficult to feel the radial pulse in these populations.

1. The brachial pulse is located by feeling the bicep tendon in the area of the antecubital fossa.
2. Move the pads of your three fingers medially from the tendon about 1 inch (2 cm) just above the antecubital fossa.
3. It can be helpful to hyperextend the patient's arm to accentuate the brachial pulse so that you can better feel it.
4. You may need to move your fingers around slightly to locate the best place to accurately feel the pulse.
5. You typically need to press fairly firmly to palpate the brachial pulse.
6. See picture below for correct placement of fingers along the brachial artery.



Brachial Pulse

Apical Pulse

The apical pulse rate is considered the most accurate pulse and is indicated when obtaining assessments prior to administering cardiac medications. It is obtained by listening with a stethoscope over a specific position on the patient's chest wall.

This page titled [Pulse](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Respiratory Rate

Respiration refers to a person's breathing and the movement of air into and out of the lungs. Inspiration refers to the process causing air to enter the lungs, and expiration refers to the process causing air to leave the lungs. A respiratory cycle (i.e., one breath while measuring respiratory rate) is one sequence of inspiration and expiration.

When obtaining a respiratory rate, the respirations are also assessed for quality, rhythm, and rate. The quality of a person's breathing is normally relaxed and silent. However, loud breathing, nasal flaring, or the use of accessory muscles in the neck, chest, or intercostal spaces indicate respiratory distress. People experiencing respiratory distress also often move into a tripod position, meaning they are leaning forward and placing their arms or elbows on their knees or on a bedside table. If a patient is demonstrating new signs of respiratory distress as you are obtaining their vital signs, it is vital to immediately notify the health care provider or follow agency protocol.

Respirations normally have a regular rhythm in children and adults who are awake. A regular rhythm means that the frequency of the respiration follows an even tempo with equal intervals between each respiration. However, newborns and infants commonly exhibit an irregular respiratory rhythm.

Normal respiratory rates vary based on age. The normal resting respiratory rate for adults is 10–20 breaths per minute, whereas infants younger than one year old normally have a respiratory rate of 30–60 breaths per minute. See Table below for ranges of normal respiratory rates by age. It is also important to consider factors such as sleep cycle, presence of pain, and crying when assessing a patient's respiratory rate.

Normal Respiratory Rate by Age

Age	Normal Range
Newborn to one month	30 – 60
One month to one year	26 – 60
1-10 years of age	14 – 50
11-18 years of age	12 – 22
Adult (ages 18 and older)	10 – 20

This page titled [Respiratory Rate](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Temperature

Accurate temperature measurements provide information about a patient's health status and guide clinical decisions. Methods of measuring body temperature vary based on the patient's developmental age, cognitive functioning, level of consciousness, and health status, as well as agency policy. Common methods of temperature measurement include oral, tympanic, axillary, temporal, no touch, and rectal routes. It is important to document the route used to obtain a patient's temperature because of normal variations in temperature in different locations of the body. Body temperature is typically measured and documented in health care agencies in degrees Celsius (°C).

Oral Temperature

Normal oral temperature is 35.8 – 37.3°C (96.4 – 99.1°F). The device has **blue coloring, indicating it is an oral or axillary thermometer**, as opposed to a **rectal thermometer that has red coloring**. Oral temperature is reliable when it is obtained close to the sublingual artery.



Oral Thermometer

TECHNIQUE

1. Remove the probe from the device and slide a probe cover (from the attached box) onto the oral thermometer without touching the probe cover with your hands.
2. Place the thermometer in the posterior sublingual pocket under the tongue, slightly off-center. Instruct the patient to keep their mouth closed but not bite on the thermometer.
3. Leave the thermometer in place for as long as is indicated by the device manufacturer.
4. The thermometer typically beeps within a few seconds when the temperature has been taken.
5. Read the digital display of the results.
6. Discard the probe cover in the garbage (without touching the cover) and place the probe back into the device.



Picture of an oral temperature being taken.

Some factors can cause an inaccurate measurement using the oral route. For example, if the patient recently consumed a hot or cold food or beverage, chewed gum, or smoked prior to measurement, a falsely elevated or decreased reading may be obtained. Oral temperature should be taken 15 to 25 minutes following consumption of a hot or cold beverage or food or 5 minutes after chewing gum or smoking.

Tympanic Temperature

The tympanic temperature is typically $0.3 - 0.6^{\circ}\text{C}$ or $0.5 - 1^{\circ}\text{F}$ higher than an oral temperature. It is an accurate measurement because the tympanic membrane shares the same vascular artery that perfuses the hypothalamus (the part of the brain that regulates the body's temperature). See the picture below of a tympanic thermometer. The tympanic method should not be used if the patient has a suspected ear infection. Accumulation of cerumen, earwax, may also reduce the accuracy of tympanic readings.



Tympanic Thermometer

TECHNIQUE

1. Remove the tympanic thermometer from its holder and place a probe cover on the thermometer tip without touching the probe cover with your hands.
2. Turn the device on.
3. Ask the patient to keep their head still.
4. For an adult or older child, gently pull the helix (outer ear) up and back to visualize the ear canal.
5. For an infant or child under age 3, gently pull the helix down.
6. Insert the probe just inside the ear canal but never force the thermometer into the ear.
7. The device will beep within a few seconds after the temperature is measured.

8. Read the results displayed, discard the probe cover in the garbage (without touching the cover), and then place the device back into the holder.



Picture showing a tympanic temperature being taken.

Axillary Temperature

The axillary method is a minimally invasive way to measure temperature and is commonly used in children. It uses the same electronic device as an oral thermometer (with blue coloring). However, the axillary temperature can be as much as 1°C lower than the oral temperature. An armpit (axillary) temperature is usually 0.3° C (0.5° F) to 0.6° C (1° F) lower than an oral temperature.

TECHNIQUE

1. Remove the probe from the device and place a probe cover (from the attached box) on the thermometer without touching the cover with your hands.
2. Ask the patient to raise their arm and place the thermometer probe in their armpit on bare skin as high up into the axilla as possible.
3. The probe should be facing behind the patient.
4. Ask the patient to lower their arm and leave the device in place until it beeps, usually about 10–20 seconds.
5. Read the displayed results, discard the probe cover in the garbage (without touching the cover), and then place the probe back into the device.



Axillary temperature being taken.

Rectal Temperature

Measuring rectal temperature is an invasive method. Some sources suggest its use only when other methods are not appropriate. However, when measuring infant temperature, it is considered a gold standard because of its accuracy. A rectal temperature is 0.5°F (0.3°C) to 1°F (0.6°C) higher than an oral temperature. **The rectal thermometer will be red.**

TECHNIQUE

Before taking a rectal temperature, ensure the patient's privacy. Wash your hands and put on gloves. For infants, place them in a supine position and raise their legs upwards toward their chest. Parents may be encouraged to hold the infant to decrease movement and provide a sense of safety. When taking a rectal temperature in older children and adults, assist them into a side lying position and explain the procedure. Remove the probe from the device and place a probe cover (from the attached box) on the thermometer. Lubricate the cover with a water-based lubricant, and then gently insert the probe 2 –3 cm (approximately 0.5 in for babies less than 6 months old to 1 inch) into the anus or less, depending on the patient's size.[18] Remove the probe when the device beeps. Read the result and then discard the probe cover in the trash can without touching it. Cleanse the device as indicated by agency policy. Remove gloves and perform hand hygiene.

Temporal Temperature

Temporal temperature is taken by using a device placed on the forehead. Temporal thermometers contain an infrared scanner that measures the heat on the surface of the skin resulting from blood moving through the temporal artery in the forehead. Temporal temperature is typically 0.5°F (0.3°C) to 1°F (0.6°C) lower than an oral temperature. It is a quick, noninvasive method, but accurate measurement is dependent on good contact with the skin and good placement on the forehead.

Normal Temperature Ranges

Method	Normal Range
Oral	35.8 – 37.3°C (96.4 -99.1°F)
Axillary	34.8 – 36.3°C (96.4 -97.3°F)
Tympanic	36.1 – 37.9°C (97.0 -100.2°F)
Rectal	36.8 – 38.2°C (98.2 -100.8°F)
Temporal	35.2 – 37.0°C (95.4 – 98.6°F)

This page titled [Temperature](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Vital Signs

Vital signs are typically obtained prior to the patient being seen by the provider. Vital signs include temperature recorded in Celsius or Fahrenheit, pulse, respiratory rate, blood pressure, and oxygen saturation using a pulse oximeter.

The order of obtaining vital signs is based on the patient and their situation. Health care professionals often place the pulse oximeter probe on the patient while proceeding to obtain their pulse, respirations, blood pressure, and temperature. However, in some situations this order is modified based on the urgency of their condition. For example, if a person loses consciousness, the assessment begins with checking their carotid pulse to determine if cardiopulmonary resuscitation (CPR) is required.

After obtaining a patient's vital signs, it is important to immediately analyze the results, recognize deviations from expected normal ranges, and report deviations to the provider.

This page titled [Vital Signs](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Karrie Stanfill](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

Index

A

accessible learning
[InfoPage](#)
accuracy
[Temperature](#)
adaptive immunity
[Natural Defenses Against Infection](#)
adaptive learning
[InfoPage](#)
age
[Respiratory Rate](#)
AIDET
[Initiating Patient Interaction](#)
American Heart Association
[Licensing](#)
antibiotic resistance
[Infection](#)
[Infection Treatment](#)
antibiotics
[Infection Treatment](#)
antifungal medications
[Infection Treatment](#)
antimicrobial stewardship
[Infection Treatment](#)
antiparasitic medication
[Infection Treatment](#)
antiviral drugs
[Infection Treatment](#)
aseptic task
[Hand Hygiene](#)
aseptic technique
[Techniques and Skills](#)
[Aseptic Technique](#)
assessment
[Providing Patient Care](#)
atrial fibrillation
[Pulse](#)
attribution
[Licensing](#)

B

bacteria
[Infection Control](#)
bacterial infections
[Infection Treatment](#)
blood pressure
[Blood Pressure](#)
[Vital Signs](#)
bloodborne pathogens
[Environmental Measures](#)
body temperature
[Temperature](#)
breathing
[Respiratory Rate](#)

C

cardiovascular conditions
[Pulse](#)
cardiovascular health
[Blood Pressure](#)

cellular defenses

[Natural Defenses Against Infection](#)
Centers for Disease Control and Prevention
[Licensing](#)
chain of infection
[Preventing Infection](#)
chemical defenses
[Natural Defenses Against Infection](#)
Chippewa Valley Technical College
[Licensing](#)
chronic respiratory conditions
[Oxygen Saturation](#)
cleaning
[Environmental Measures](#)
clinical decisions
[Temperature](#)
clinical skills
[General Survey](#)
collaborative education
[InfoPage](#)
contaminated waste
[Environmental Measures](#)
COPD
[Oxygen Saturation](#)
cough etiquette
[Respiratory Hygiene](#)
CPR
[Vital Signs](#)
critical thinking
[General Survey](#)
cultural_safety
[Initiating Patient Interaction](#)
curriculum development
[InfoPage](#)

D

data collection
[General Survey](#)
developmental_stage
[Initiating Patient Interaction](#)
diagnostic tests
[Providing Patient Care](#)
disease
[Infection](#)
disease prevention
[Infection Control](#)
disinfecting
[Environmental Measures](#)

E

environmental measures
[Techniques and Skills](#)
expiration
[Respiratory Rate](#)

F

face shields
[Personal Protective Equipment \(PPE\)](#)
Five Moments of Hand Hygiene
[Hand Hygiene](#)

fungi

[Infection Control](#)

G

gloves
[Personal Protective Equipment \(PPE\)](#)

H

hand hygiene
[Techniques and Skills](#)
[Hand Hygiene](#)
[Respiratory Hygiene](#)
[Personal Protective Equipment \(PPE\)](#)
[Aseptic Technique](#)
hand_hygiene
[Initiating Patient Interaction](#)
health assessment
[Oxygen Saturation](#)
health care
[Personal Protective Equipment \(PPE\)](#)
[Blood Pressure](#)
[Temperature](#)
health care professionals
[Vital Signs](#)
health care settings
[Hand Hygiene](#)
health care workers
[Hand Hygiene](#)
[Respiratory Hygiene](#)
health education
[Respiratory Hygiene](#)
healthcare procedures
[Aseptic Technique](#)
healthcare providers
[Infection Treatment](#)
heart rate
[Pulse](#)
hemoglobin saturation
[Oxygen Saturation](#)
hypertension
[Blood Pressure](#)
hypotension
[Blood Pressure](#)

I

immune cells
[Natural Defenses Against Infection](#)
immune response
[Infection](#)
[Natural Defenses Against Infection](#)
immune system
[Infection Control](#)
[Providing Patient Care](#)
immunity
[Infection](#)
infection
[Techniques and Skills](#)
[Infection Control](#)
[Infection](#)
[Providing Patient Care](#)

infection control

[Techniques and Skills](#)
[Respiratory Hygiene](#)
[Personal Protective Equipment \(PPE\)](#)
[Environmental Measures](#)
[Aseptic Technique](#)

infection prevention

[Preventing Infection](#)
[Hand Hygiene](#)
[Aseptic Technique](#)

infectious agent

[Preventing Infection](#)

inflammation

[Natural Defenses Against Infection](#)
[Providing Patient Care](#)

innate immunity

[Natural Defenses Against Infection](#)

inspiration

[Respiratory Rate](#)

interactive textbooks

[InfoPage](#)

interventions

[Preventing Infection](#)

interview techniques

[General Survey](#)

invasive

[Temperature](#)

L

LibreTexts

[InfoPage](#)

licensing

[Licensing](#)

life_span

[Initiating Patient Interaction](#)

lungs

[Respiratory Rate](#)

M

masks

[Personal Protective Equipment \(PPE\)](#)

measurement

[Blood Pressure](#)
[Temperature](#)

medical asepsis

[Aseptic Technique](#)

medical assessment

[Blood Pressure](#)

medical assistant

[General Survey](#)

medical assistants

[Preventing Infection](#)

medical equipment

[Environmental Measures](#)

medical_assistant

[Initiating Patient Interaction](#)

metabolic rate

[Providing Patient Care](#)

microbiome

[Infection Control](#)
[Infection](#)

mode of transmission

[Preventing Infection](#)

N

noninvasive measurement

[Oxygen Saturation](#)

nonspecific immunity

[Natural Defenses Against Infection](#)

normal flora

[Infection Control](#)

normal heart rate

[Pulse](#)

normal range

[Temperature](#)

normal respiratory rates

[Respiratory Rate](#)

nursing

[Licensing](#)
[Infection](#)

nursing care

[Providing Patient Care](#)

nursing guidelines

[Blood Pressure](#)

O

objective data

[General Survey](#)

OER

[InfoPage](#)

open education

[InfoPage](#)

oxygen saturation

[Oxygen Saturation](#)
[Vital Signs](#)

oxygenation status

[Oxygen Saturation](#)

P

parasites

[Infection Control](#)

pathogen

[Infection](#)

pathogens

[Infection Control](#)
[Natural Defenses Against Infection](#)

patient assessment

[General Survey](#)
[Pulse](#)
[Vital Signs](#)

patient care

[Techniques and Skills](#)
[Respiratory Hygiene](#)
[Vital Signs](#)

patient communication

[General Survey](#)

patient education

[Infection Treatment](#)

patient safety

[Hand Hygiene](#)
[Aseptic Technique](#)
[Blood Pressure](#)

patient_care

[Initiating Patient Interaction](#)

patient_identification

[Initiating Patient Interaction](#)

patient_interaction

[Initiating Patient Interaction](#)

personal protective equipment

[Techniques and Skills](#)
[Respiratory Hygiene](#)
[Personal Protective Equipment \(PPE\)](#)
[Aseptic Technique](#)

personal_protective_equipment

[Initiating Patient Interaction](#)

physical defenses

[Natural Defenses Against Infection](#)

portal of entry

[Preventing Infection](#)

portal of exit

[Preventing Infection](#)

PPE

[Techniques and Skills](#)
[Personal Protective Equipment \(PPE\)](#)
[Environmental Measures](#)

preventing infection

[Techniques and Skills](#)

proper techniques

[Hand Hygiene](#)

public domain

[Licensing](#)

public health

[Infection Treatment](#)

pulse

[Pulse](#)
[Vital Signs](#)

pulse assessment

[Pulse](#)

pulse force

[Pulse](#)

pulse oximeter

[Oxygen Saturation](#)

pulse oximetry

[Oxygen Saturation](#)

pulse rhythm

[Pulse](#)

R

reservoir

[Preventing Infection](#)

respiration

[Respiratory Rate](#)

respiratory cycle

[Respiratory Rate](#)

respiratory hygiene

[Techniques and Skills](#)
[Respiratory Hygiene](#)

respiratory infections

[Respiratory Hygiene](#)

respiratory rate

[Respiratory Rate](#)
[Vital Signs](#)

S

safety protocols

[Personal Protective Equipment \(PPE\)](#)

sharps safety

[Environmental Measures](#)

soap and water

[Hand Hygiene](#)

SpO2

[Oxygen Saturation](#)

standard precautions

[Environmental Measures](#)

sterile technique

[Aseptic Technique](#)

student support

[InfoPage](#)

subjective data

[General Survey](#)

surgical asepsis

[Aseptic Technique](#)

susceptible host

[Preventing Infection](#)

symptoms

[Infection](#)

[Providing Patient Care](#)

T

technique

[Temperature](#)

temperature

[Temperature](#)

[Vital Signs](#)

textbook

[Licensing](#)

therapeutic drug monitoring

[Providing Patient Care](#)

thermometer

[Temperature](#)

V

viruses

[Infection Control](#)

vital signs

[Providing Patient Care](#)

[Blood Pressure](#)

[General Survey](#)

[Pulse](#)

[Respiratory Rate](#)

[Vital Signs](#)

W

World Health Organization

[Licensing](#)

Glossary

Sample Word 1 | Sample Definition 1

Detailed Licensing

Overview

Title: [Medical Assistant - Introduction to Clinical Skills \(Stanfill\)](#)

Webpages: 31

All licenses found:

- [CC BY 4.0](#): 93.5% (29 pages)
- [Undeclared](#): 6.5% (2 pages)

By Page

- [Medical Assistant - Introduction to Clinical Skills \(Stanfill\)](#) - [CC BY 4.0](#)
 - [Front Matter](#) - [CC BY 4.0](#)
 - [TitlePage](#) - [CC BY 4.0](#)
 - [InfoPage](#) - [CC BY 4.0](#)
 - [Table of Contents](#) - [Undeclared](#)
 - [Licensing](#) - [CC BY 4.0](#)
 - [Techniques and Skills](#) - [CC BY 4.0](#)
 - [Infection Control](#) - [CC BY 4.0](#)
 - [Infection](#) - [CC BY 4.0](#)
 - [Natural Defenses Against Infection](#) - [CC BY 4.0](#)
 - [Infection Treatment](#) - [CC BY 4.0](#)
 - [Preventing Infection](#) - [CC BY 4.0](#)
 - [Hand Hygiene](#) - [CC BY 4.0](#)
 - [Respiratory Hygiene](#) - [CC BY 4.0](#)
 - [Personal Protective Equipment \(PPE\)](#) - [CC BY 4.0](#)
 - [Environmental Measures](#) - [CC BY 4.0](#)
 - [Aseptic Technique](#) - [CC BY 4.0](#)
 - [Providing Patient Care](#) - [CC BY 4.0](#)
 - [Initiating Patient Interaction](#) - [CC BY 4.0](#)
 - [Blood Pressure](#) - [CC BY 4.0](#)
 - [General Survey](#) - [CC BY 4.0](#)
 - [Oxygen Saturation](#) - [CC BY 4.0](#)
 - [Pulse](#) - [CC BY 4.0](#)
 - [Respiratory Rate](#) - [CC BY 4.0](#)
 - [Temperature](#) - [CC BY 4.0](#)
 - [Vital Signs](#) - [CC BY 4.0](#)
 - [Back Matter](#) - [CC BY 4.0](#)
 - [Index](#) - [CC BY 4.0](#)
 - [Glossary](#) - [CC BY 4.0](#)
 - [Detailed Licensing](#) - [CC BY 4.0](#)
 - [Detailed Licensing](#) - [Undeclared](#)