With research and the discovery that microorganisms cause infection came the realization that, to prevent illness or disease, it is necessary to somehow inhibit or stop their growth and reproduction. The method of aseptic technique initiated by Joseph Lister (1827–1912) helped reduce morbidity and mortality from surgery and wound care. Lister is known as the father of aseptic technique, although many scientists, researchers, and physicians contributed to its development.

These methods are still used in health care today. It is imperative in today’s health care environment that nurses practice effective infection prevention and control measures, not only for the purpose of protecting patients from drug-resistant microorganisms and occupational exposure, but also to keep health care delivery costs down.

**ASEPSIS**

The increase of transmissible infections, not only in health care institutions but also in the home, is an issue of great societal concern. Microorganisms (any tiny, usually microscopic, entity capable of carrying on living processes) are naturally present on and in the human body, as well as in the environment. Many of these microorganisms are harmless (nonpathogenic)
and in most individuals do not produce disease. Some are even helpful. However, if an individual is highly susceptible to infection, it is possible for the nonpathogenic microorganisms to be dangerous. There are also known microorganisms (pathogens) that do cause specific diseases or infections.

Any patient entering a health care facility is at a greater risk of developing an infection because of lowered resistance, increased exposure to numbers and types of disease-causing organisms, or the need for an invasive procedure. Your knowledge of infection, the application of infection prevention and control principles, and use of common sense help protect patients from infection. In whatever action you perform as a nurse, be sure that infection prevention and control is part of your routine. Infection prevention and control consists of the implementation of policies and procedures in hospitals and other health care facilities to minimize the spread of health care–associated or community-acquired infections to patients and other staff members. In many situations, you will be exposed to pathogenic microorganisms. For your own protection as well as that of others, learn to prevent the spread of infection by using both routine and specialized practices of cleanliness and disinfection. These techniques aid in accomplishing asepsis (absence of pathogenic microorganisms). Asepsis is divided into the following two categories:

1. Medical asepsis consists of techniques that inhibit the growth and spread of pathogenic microorganisms. Medical asepsis is also known as clean technique and is used in many daily activities, such as hand hygiene and changing patients’ bed linen. You follow principles of medical asepsis in the home, for instance, with the common practice of washing your hands before preparing food.

2. Surgical asepsis destroys all microorganisms and their spores (the reproductive cell of some microorganisms, such as fungi or protozoa). Surgical asepsis is known as sterile technique and is used in specialized areas or skills, such as care of surgical wounds, urinary catheter insertion, invasive procedures, and surgery.

**INFECTION**

For a microorganism to be transported and be effective in continuing contamination, it follows a definite cycle or chain of events. The following six elements are necessary for infection to occur (Figure 12-1):

1. The infectious agent—a pathogen
2. Reservoir—where the pathogen can grow
3. Exit route from reservoir
4. Method or vehicle of transportation, such as exudate, feces, air droplets, hands, and needles
5. Entrance through skin, mucous lining, or mouth
6. Host—another person or animal

To prevent the spread of a microorganism, the cycle must be interrupted. Through daily practices of medical asepsis, this is possible. These practices help to inhibit (to stop or slow a process) the growth and reduce the number of microorganisms.

**FIGURE 12-1** The chain of infection.
INFECTIONOUS AGENT
Pathogenic microorganisms are infectious agents. These pathogens vary among bacteria, viruses, yeasts, fungi, and protozoa. All these microorganisms require food for growth and a suitable environment in which to live. Unwashed hands, wound dressings, soiled linen, and decaying teeth provide ideal areas for pathogenic growth. The strength of the microorganism, the number of microorganisms present, the effectiveness of a person’s immune system, and the length of exposure to the microorganisms determine a pathogen’s ability to produce disease. You as a nurse have a duty to provide a safe environment for a patient. In large part, you accomplish this by performing hand hygiene, donning gloves, disinfection (the use of a chemical that can be applied to objects to destroy microorganisms), using an antiseptic (a substance that tends to inhibit the growth and reproduction of microorganisms—may be used on humans), and sanitizing.

Bacteria
Bacteria have many different characteristics. In addition to their three basic shapes—round, oblong, and spiral—there are many variations. Some are elongated or have pointed ends, and some are flattened on one side. Some are shaped like commas, and others appear square. Spirilla are often tightly coiled, like a corkscrew. During cell division, some bacteria remain together to form pairs, whereas others will perhaps form long chains. All these alternative details are part of how we are able to identify specific kinds of bacteria.

Bacteria also frequently have different chemical compositions, require different nutrients, and form different waste products. Aerobic bacteria grow only in the presence of oxygen, whereas anaerobic bacteria grow only in the absence of oxygen. Some bacteria are capable of movement. Their motility is possible because of fine, hairlike projections—flagella—that arise from the bacterial cell. These projections move in a wavelike fashion to propel the cell. Some bacteria have only one flagellum attached to one end of the cell, and others have many flagella surrounding the cell. Locomotion of the spirochete is achieved by a wiggling motion involving the entire cell body.

Some bacteria form a specialized structure called a spore. The spore is a round body that is formed by the bacterium when conditions are unfavorable for growth of the bacterium. The spore enlarges until it is as large as the bacterial cell and is surrounded by a capsule. Eventually the portion of the cell surrounding the spore disintegrates. The spore remains dormant until environmental conditions become favorable for growth. Then the spore germinates and begins reproducing. Characteristically, spores have a high degree of resistance to heat and disinfectants. They are impervious (unable to be affected) to the usual laboratory staining methods.

Some bacteria have the ability to form capsules about the cell wall. These mucilaginous (thick, sticky, slimy substance) envelopes seem to form when the bacterial environment is unfavorable; it is believed that the formation may be a defensive mechanism to protect the bacteria. The composition of the capsules varies with the species of bacteria. However, they are possibly composed of protein or fat substances, and some will probably contain nitrogen and phosphorus. As with spores, staining in the laboratory usually requires special procedures. Capsule formation also contributes to the development of multidrug resistance. When capsules are present, antibiotic therapy is sometimes ineffective because the capsule prevents the drug from reaching the bacteria within the capsule.

Knowing the type of organism is important to the treatment of the patient. With many diseases, proper diagnosis and treatment are not possible until the specific microorganism causing the illness has been identified. Specially trained laboratory personnel perform this identification. In some instances, they examine a specimen before staining it, but this is usually less satisfactory. Most bacteria are not visible without a special staining process, in which a dye is applied to a specially prepared glass slide containing a small amount of the material to be examined. It is possible to identify most bacteria by this simple process; however, other bacteria require additional staining. Depending on whether it is possible to remove a color by using a solvent or the color is retained after the use of the solvent, the organism is identified as being gram positive or gram negative. Some bacteria are known as acid-fast bacteria, depending on the staining process. Special staining is required for bacteria that have flagella, spores, or capsules (Figure 12-2).

You will collect specimens of body fluids and secretions suspected of containing pathogenic organisms in sterile containers and send them to the laboratory for culture and sensitivity tests. Laboratory personnel will transfer the specimen to a special culture medium that promotes growth. They will then study the culture and identify the pathogens as just described. The results of the sensitivity tests assist the practitioner in determin-
ing which antimicrobial agent will effectively inhibit the pathogens’ growth. The practitioner then orders appropriate antimicrobial agents on the basis of these tests, which typically take 48 to 72 hours to complete. Different organisms require different antibiotics to be destroyed.

Bacterial infections are transmitted from person to person by direct contact, by inhalation of droplet nuclei, and by indirect contact with articles contaminated with the pathogen. Some are also transmitted through the ingestion of contaminated food and drink (Figure 12-3).

The *Streptococcus* bacterium is responsible for more diseases than any other organism, but methicillin-resistant *Staphylococcus aureus* (MRSA) is growing in number and is responsible for a number of serious and sometimes fatal infections, such as necrotizing MRSA pneumonia. The incidence of MRSA has been estimated to be 3.95 cases per 1000 patient discharges (Kuehnert et al., 2005). Some strains produce serious or even fatal diseases; other strains produce disease only under special conditions; and some strains are nonpathogenic (Table 12-1). The β-hemolytic group of streptococci is responsible for 4.1 to 7.2 cases per 100,000 people. Some of the diseases caused by this group are extremely serious, sometimes fatal.

Rocky Mountain spotted fever has been found in almost every area of the United States, and its prevalence seems to be increasing. It is transmitted to humans through the bite of an infected tick. Several varieties of ticks carry the disease. The ticks live on many different kinds of animals found in rural and wooded areas. They are also able to live on common house pets such as cats and dogs. People working in areas where ticks are known to be abundant are more likely to become infected. The tick attaches itself to the skin, and the longer it remains attached, the more likely the person is to become infected. In removing the tick from the skin, it is essential to take great care not to crush or squeeze it.

**Anthrax**

The spore-forming bacterium *Bacillus anthracis* causes the acute infectious disease of anthrax. Anthrax infection occurs in three forms:

- Cutaneous (skin) (Figure 12-4)
- Inhalation
- Gastrointestinal

Anthrax occurs more commonly in animals, but it also has the ability to infect humans. It is seen more often in agricultural regions of South and Central America, southern and eastern Europe, Asia, Africa, the Caribbean, and the Middle East, where it is found in animals. It rarely occurs in domesticated animals in the United States.

*B. anthracis* spores are able to live in the soil for many years. Casual contact from person to person does not spread anthrax, nor does sharing an office; the infection is not transmitted by coughing or sneezing. In cases of intentional exposure, as in a bioterrorist
release, the most likely routes of infection are breathing in the spores or spore contact with skin. B. anthracis is considered by the Centers for Disease Control and Prevention to be one of a number of potential agents for use in biological terrorism.

Anthrax infection is diagnosed when B. anthracis is detected in blood, skin lesions, or respiratory secretions by means of a laboratory culture or by measuring specific antibodies in the blood of infected people.

Treatment consists of antibiotics such as ciprofloxacin (Cipro) or doxycycline (Vibramycin). There is a vaccine to prevent anthrax infection. Vaccination is recommended for those at high risk of exposure, such as laboratory scientists handling the bacterium or members of the armed forces. If left untreated, anthrax can be fatal.

### Viruses

Viruses are the smallest known agents to cause disease. They are not complete cells but are composed of either RNA or DNA. They consist of a protein coat around a nucleic acid core and depend on the metabolic processes of the cell they enter. Before 1900, scientists discovered that certain agents, unlike bacteria, have the ability to pass through a laboratory filter. In addition, they were unable to observe these tiny bod-
ies with the ordinary microscope. In 1898, Martinus W. Beijerinck called these small bodies *viruses*, and they became known as *filterable viruses*.

For years, scientists knew little about viruses, even though they were able to observe their effect on humans and animals. In 1941, the electron microscope became available. With this advancement, the science of virology was born and a whole new era in the study of human disease was opened. In addition, the development of other tools and techniques has resulted in rapid advances in the study of viruses: the use of certain dyes that become luminous when exposed to ultraviolet light (fluorescent microscopy), tissue culture methods, ultracentrifuge, cytochemistry, and the development of other technical laboratory aids.

Viruses gain entrance to the body through various portals: the respiratory tract, the gastrointestinal tract, or broken skin resulting from an animal bite. Sometimes the virus is injected by a mosquito or hypodermic needle. Viruses are selective in the type of body cells they attack, but once they have found cells for which they have an affinity, they enter the cell and reproduce rapidly. As they multiply, they interrupt the cell activities and use the cell material to produce new virus material.

Viral infections are usually self-limiting. They run a course, and recovery usually occurs. One exception is rabies, which is almost always fatal. Another exception is acquired immunodeficiency syndrome (AIDS). As the human immunodeficiency virus (HIV) reproduces and the immune system continues to be stressed to the point where it can no longer fight off even the most common infection, the patient then receives the diagnosis of AIDS. Other viral diseases have the capacity to cause death if complications occur or if they attack extremely weak, elderly, or debilitated people. The common cold is caused by a virus; the typical aching feeling, fever, and chilling sensations it entails are usually relieved by staying in bed and taking certain over-the-counter remedies. No medicine will cure the cold; medicine only relieves the discomfort. Antibiotics do not alter the course of the vast majority of viral diseases.

Viruses are classified in various ways, either according to the human diseases they cause or by the characteristics of a specific group. In the latter classification system, each subgroup will often have many types or strains (see Table 12-1).

**Fungi**

Fungal (mycotic) infections are among the most common diseases found in humans. Fungi are among the most plentiful forms of life. They belong to the plant kingdom, and although many of them are harmless, some are responsible for infections. Fungi types that are familiar to everyone include the fuzzy black, green, or white growth on stale bread, decayed fruit, or damp clothing. Mycotic infections are diseases caused by yeasts and molds. Some are superficial, involving the skin and the mucous membranes. Most frequently, the infections involve the external layers of the skin, the hair, and the nails and are commonly referred to as ringworm (dermatomycosis). In children, the most frequent site affected is the scalp. The condition is considered infectious, and often the child is not permitted to attend school until the infection has been cured. Other common sites include men’s beards (barber’s itch), the feet (athlete’s foot), and around the nails. Domestic pets sometimes have ringworm infection and are frequently the source of infection for humans (see Table 12-1).

Fungi also invade the deeper tissues of the body at times. Most of these infections produce no signs or symptoms; however, some become serious and potentially fatal, especially in a patient who is severely immunocompromised. Those most common in the United States are coccidioidomycosis (valley fever) and histoplasmosis (a systemic fungal respiratory disease).

**Protozoa**

The protozoa are single-celled animals; in some forms, they exist everywhere in nature. Some of the parasitic forms of protozoa are found in the intestinal tract, the genitourinary tract, the respiratory tract, and the circulatory system of humans and other animals. The disease-producing protozoa are responsible for malaria, amebic dysentery, and African sleeping sickness (see Table 12-1).

**RESERVOIR**

To thrive, organisms require food and a proper atmosphere. Characteristics of an environment that supports organism growth include food, oxygen, water, temperature, pH, and light. Any natural habitat of a microorganism that promotes growth and reproduction is a *reservoir*. Many areas of the body typically host a variety of microorganisms, but the presence of these microorganisms does not always cause illness. Examples of reservoirs are soiled or wet dressings and hospital equipment such as a bedside stand, an overbed table, suction equipment, or urinary drainage bags.

A *carrier*, or vector, is a person or animal who does not become ill but harbors and spreads an organism, causing disease in others.

Among your functions as a nurse is to prevent known carriers from coming into contact with the patient, change wet or soiled dressings, clean hospital equipment, change suction canisters routinely, and use medical asepsis when handling urinary drainage bags (Box 12-1).

**EXIT ROUTE**

A microorganism does not have the capacity to cause disease in another host without finding a point of escape from the reservoir. Exit routes in humans are the
A contaminated *vehicle* is the means by which microorganisms are carried about and transported to the next host, once they have left the reservoir. Contamination means a condition of being soiled, stained, touched by, or otherwise exposed to harmful agents; an example is the entry of infectious or toxic materials into a previously clean or sterile environment, making an object potentially unsafe for use. If the vehicle is a living carrier, it is called a *vector*. If the vehicle is an inanimate (nonliving) object, it is called a *fomite*. Some of the many common fomites are computers (many people touch the computer throughout the day), medical records and charts, stethoscopes, thermometers, bandage scissors, used tissues, drinking glasses, needles, and soiled dressings.

Transmission by this kind of common contact with a fomite or vector is known as the indirect method of transmission. Transmission through direct contact is also possible, such as when you use poor hand hygiene technique and then turn or bathe a patient.

Air currents easily carry microorganisms. When you make a bed, therefore, do not shake the linens. Use a dampened or treated cloth when dusting to prevent circulation of dust particles.

The floor is the dirtiest area in any building. Discard anything dropped onto it, such as soiled linens and other supplies. Feet and furniture are the only items that belong on the floor.

Because so many factors can promote the spread of infection to a patient, it is essential for all hospital personnel providing direct care (physical therapists and physicians, as well as nurses) and those performing diagnostic and support services (laboratory technicians, respiratory therapists, dietary workers) to follow infection prevention and control practices to prevent or minimize the spread of infection.

**ENTRANCE OF MICROORGANISMS**

Once the microorganism has exited the reservoir and has been transmitted to a susceptible host, it has to find a way to enter. When the host’s defense mechanisms are reduced (see the next section), the microorganism has a greater chance to enter. If the patient’s skin is punctured with a contaminated needle, microorganisms are able to enter and be absorbed into the bloodstream. Incorrect handling of a wound dressing allows microorganisms to enter the open wound and cause an infection.

Many of the entrance and exit routes microorganisms take are the same, and methods used to prevent or control both processes are also similar. The skin is the first line of defense; keep it intact, lubricated, and clean. Closely observe areas of possible skin impairment, and treat them accordingly (see Chapter 18).

Accidental needlesticks are a hazard for all health personnel. Report them immediately so that it is possible to start prophylactic measures. Available and appropriate waste containers are essential for safe disposal of sharp instruments. Never recap needles.

Improper care of Foley catheter or other drainage apparatus often provides an entrance for microorganisms and allows the infectious process to continue.
Ensure that tubes remain connected and intact. Take care when turning, positioning, or transferring a patient to prevent tubes from becoming tangled or pulling apart.

Correct cleansing of wounds will prevent the entrance of microorganisms. To accomplish this, clean away from the wound, wear sterile gloves, and use an antiseptic agent. Wear gloves when handling soiled dressings, and place the dressings in the appropriate container for disposal.

**HOST**

A host is an organism in which another, usually parasitic, organism is nourished and harbored.

Susceptibility to an infection is defined by the amount of resistance shown to the pathogen. Microorganisms are constantly in contact with people, but an infection will not develop unless a person is susceptible to the microorganism's strength and numbers. As the pathogen's strength and numbers increase, the person becomes more susceptible. Factors that affect a person's immunologic defense mechanisms are described in Box 12-2.

Immunizations have proven effective in reducing susceptibility to infectious disease. These are given before a person has been exposed to a disease (to provide protection before contact) or after exposure (if the person's history indicates possible contact with an infectious microorganism). Table 12-2 lists the normal defense mechanisms against infection.

Be a role model and keep up to date with your own immunizations, as well as teaching your patients and other caregivers to do so.

**INFECTIOUS PROCESS**

When you understand the chain of infection, you gain the ability to intervene to prevent infections from developing. When the patient acquires an infection, there are signs and symptoms you will be able to observe, and appropriate actions to take to prevent its spread. Infections follow a progressive course (Box 12-3). The severity of the patient's illness depends on the extent of the infection, the virulence (disease-causing power) of the microorganisms, and the susceptibility of the host.

### Box 12-2 Factors Affecting Immunologic Defense Mechanisms

- Increasing age and extreme youth
- Stress
- Nutritional status
- Hereditary factors
- Disease processes
- Environmental factors
- Medical therapy
- Chemothery
- Radiation
- Lifestyle
- Occupation
- Diagnostic procedures
- Travel history
- Trauma

If infection is **localized** (e.g., a superficial wound infection), proper care controls the spread and minimizes the illness. The patient usually experiences localized symptoms such as pain and tenderness at the wound site. An infection that affects the entire body instead of just a single organ or part is **systemic** and has potential to become fatal.

The course of an infection influences the level of nursing care you will provide. You are responsible for properly administering antimicrobial agents and monitoring the response to drug therapy. Supportive therapy includes providing adequate nutrition and rest to bolster the body’s defense against the infectious process. The complexity of care further depends on body systems affected by the infection.

Regardless of whether infection is localized or systemic, you play a critical role in minimizing its spread. For example, the organism causing a simple wound infection will often spread to involve an incisional wound site if you use improper technique during the dressing change. If you have a break in your own skin, it is also possible for you to acquire infections from patients if your technique for controlling infection transmission is inadequate.

**INFLAMMATORY RESPONSE**

The body’s response to injury or infection at the cellular level is inflammation. Inflammation is a protective vascular reaction that delivers fluid, blood products,
and nutrients to interstitial tissues in the area of an injury. The process neutralizes and eliminates pathogens or necrotic (dead) tissues and establishes a means of repairing body cells and tissues. Signs of inflammation frequently include edema (swelling), rubor (redness), heat, pain or tenderness, and loss of function in the affected body part. When inflammation becomes systemic, other signs and symptoms develop, including fever, leukocytosis, malaise, anorexia, nausea, vomiting, and lymph node enlargement.

The inflammatory response is triggered by physical agents, chemical agents, or microorganisms. Mechanical trauma, temperature extremes, and radiation are examples of physical agents. Chemical agents include external and internal irritants such as harsh poisons or gastric acid. Microorganisms trigger this response as well, as previously discussed. The inflammatory response sometimes occurs in the absence of an infectious process.

**HEALTH CARE–ASSOCIATED INFECTIONS**

More than 40 million people are admitted to hospitals each year, and as many as 10% of them acquire a health care–associated infection (HAI) while there. Criteria for HAI’s require that the infection manifests...
at least 48 hours after hospitalization or contact with another health agency. These infections pose a far-reaching and serious problem. Hospitals harbor microorganisms that are often highly virulent (of or pertaining to a highly pathogenic or rapidly progressive condition), making them more likely places to acquire an infection. The patient’s immune system will probably already be weakened from disease or therapy, which makes the patient more susceptible to pathogens. HAs not only necessitate longer hospital stays for the patient but also increase costs for both the patient and the hospital.

An exogenous (growing outside the body) infection is caused by microorganisms from another person. An endogenous (growing within the body) infection is caused by the patient’s own normal microorganisms, which become altered and overgrow or are transferred from one body site to another (e.g., microorganisms in fecal material are transferred to skin by hands and infect a wound).

HAs are most commonly transmitted by direct contact between health care personnel and patients or from patient to patient. For this reason, it is crucial to place a strong emphasis on sanitary procedures, such as hand hygiene and environmental cleaning.

You are responsible for providing the patient with a clean and safe environment. Your conscientiousness and accuracy in performing clean and aseptic procedures increase the effectiveness of infection prevention and control. To decrease the occurrence or duration of HAs, many agencies have an infection prevention and control department, which investigates and establishes policies to ensure that all personnel maintain aseptic techniques while performing a procedure on a patient. These procedures include clean technique, which is used in all areas, and sterile technique, which is used in specialized areas.

HAs significantly increase health care costs. Extended lengths of stay in health care institutions increase disability, and prolonged recovery times add to the expenses the patient has to bear, as well as the health care institution and the funding bodies (Medicare and Medicaid). Beginning in the fall of 2008, Centers for Medicare and Medicaid Services (CMMS) no longer reimburse hospitals for catheter-associated urinary tract infections (UTIs) and bloodstream infections. In coming years, surgical site infections and ventilator-associated infections will also cease to be reimbursed. Often costs for HAs are not reimbursed; as a result, prevention carries financial benefit.

**INFECTION PREVENTION AND CONTROL TEAM**

Infection prevention and control is a valuable discipline in the health care arena. The Occupational Safety and Health Administration (OSHA), The Joint Commission risk management, and hospital administration place an ever-increasing emphasis on infection prevention and control. Administratively, infection preventionists and other members of the infection prevention and control team function within the hospital via the infection prevention and control committee.

**INFECTION PREVENTIONIST**

Many agencies employ nurses who are specially trained in infection prevention and control. They are responsible for advising hospital personnel on the development and implementation of safe patient care delivery practices and for monitoring infection outbreaks within the health care agency. Duties of an infection preventionist include:

- Providing staff education on infection prevention and control.
- Reviewing and revising infection prevention and control policies and procedures to ensure they are in compliance with local, state, and federal regulations as well as with certification agencies such as CMMS and The Joint Commission.
- Reviewing patients’ medical records and laboratory reports and recommending appropriate transmission-based isolation procedures.
- Screening patient records for community-acquired infections (those that are acquired outside of the health care setting). These infections often are distinguished from health care–associated infections by the type of organisms that affect patients who are recovering from a disease or injury.
- Consulting with occupational health departments concerning recommendations to prevent and control the spread of infection among health care personnel, such as tuberculosis testing.
- Compiling data and analyzing the results regarding the epidemiology of health care–associated (or health care–acquired) infections.
- Notifying the local public health department of incidences of communicable diseases.
- Conferring with various hospital departments to investigate unusual events or clusters of infection.
- Educating patients and families in the prevention and control of infection.
- Identifying infection control problems with medical or patient equipment.
- Assessing microorganism sensitivity to antibiotics in use and reminding medical staff of resistance demonstrated by sensitivity examination.

An infection preventionist is a valuable resource in the prevention and control of HAs.

**OCCUPATIONAL HEALTH SERVICE**

The occupational health service plays an important role in the prevention or the control of an infection in a health care setting by taking measures to protect the health care worker and patients from certain infections.

When any needlestick occurs, it is essential to report it immediately. Hepatitis B, or serum hepatitis, is the
infection most commonly transmitted by contaminated needles. Health care agencies require workers who have had a needlestick to complete an injury report and seek appropriate treatment (Box 12-4).

Many agencies mandate all workers and students to obtain titers as proof of immunity against varicella, measles, mumps, and rubella. Titers are lab tests that measure the amount of an antibody in the bloodstream. If the amount of the antibody is not high enough, the institution will often require personnel to receive a vaccination or be revaccinated to prevent the disease.

**STANDARD PRECAUTIONS**

With the increased awareness of contamination from bloodborne pathogens (e.g., hepatitis B virus, HIV) came the realization that definite precautions are necessary to prevent infections.

The Centers for Disease Control and Prevention (CDC), part of the U.S. Department of Health and Human Services, provides facilities and services for investigation, prevention, and control of disease. The CDC has conducted studies on health care workers with documented skin or mucous membrane exposure to blood or body fluids of infected patients (Siegel et al., 2007). The studies show that infection resulted when health care workers did not use protective measures.

It is difficult to accurately identify all patients infected with bloodborne pathogens. In the past, the CDC recommended that health care workers use “universal blood and body fluid precautions,” or “universal precautions,” and body substance isolation when caring for all patients. These two sets of precautions have now been incorporated into one standard set of guidelines, called **standard precautions**.

The increased incidence of tuberculosis (TB) has led to a heightened stress, along with these precautions, on wearing the particulate respirator mask (Figure 12-5) to protect against airborne pathogens.

The CDC guidelines for isolation precautions in hospitals, revised in 2007, have been adopted by many health care facilities (Siegel et al., 2007). The goal of these guidelines is to interrupt the chain of infection and reduce transmission of bloodborne pathogens and other potentially infectious materials from moist body substances. They apply to (1) blood; (2) all body fluids,
Hand hygiene is the single most important and basic preventive technique for interrupting the infectious process. Box 12-6 indicates when it is essential to initiate hand hygiene.

**Box 12-5 Standard Precautions**

**HAND HYGIENE**
- Hand hygiene is considered of utmost importance when practicing standard precautions. Hands are to be washed before patient care and after touching blood, body fluids, secretions, excretions, and contaminated items, regardless of whether gloves are worn. Perform hand hygiene immediately after gloves are removed, between patient contacts, and when otherwise indicated to prevent transfer of microorganisms to other patients or environments. It may be necessary to wash hands between tasks and procedures on the same patient to prevent cross-contamination of different body sites.
- Use approved soaps and alcohol-based hand sanitizers and lotions.

**GLOVES**
- Wear clean, unsterile gloves when the potential for touching blood, body fluids, secretions, excretions, and contaminated items exists. Put on clean gloves just before touching mucous membranes and nonintact skin. Change gloves between tasks and procedures on the same patient after contact with material that possibly contains a high concentration of microorganisms. Remove gloves promptly after use, before touching noncontaminated items and environmental surfaces. Perform hand hygiene immediately after removing gloves to prevent transfer of microorganisms to other patients or environment.

**MASK, EYE PROTECTION, FACE SHIELD**
- Wear a mask and eye protection or a face shield to protect mucous membranes of the eyes, the nose, and the mouth during procedures and patient care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions.

**GOWN**
- Wear a fluid-resistant gown (a clean, unsterile gown is adequate) to protect skin and prevent soiling of clothing during procedures and patient care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions or cause soiling of clothing. Select a gown that is appropriate for the activity and amount of fluid likely to be encountered. Remove the soiled gown as promptly as possible and perform hand hygiene to prevent transfer of microorganisms to other patients or environments.

**MISCELLANEOUS GUIDELINES**
- Place used sharps, such as needles or scalpels, in a designated sharps disposal container.
- Do not purposefully bend, break, or recap needles.
- Place disposable wastes and articles contaminated with blood or large amounts of body fluids in a biowaste container for a trash pickup.
- Clean up spills of blood or body fluids per hospital protocol (i.e., blood spill kit).
- Place all soiled linen in a laundry bag. Do not overfill the bag, to prevent contamination of the environment.
- For patients with diarrhea: Strongly recommend soap and water for hand hygiene.
- For patients who are coughing: Wear a face mask if within 3 feet of patient and teach patient about respiratory hygiene.
- Use mouthpieces, resuscitator bags, or other ventilation devices if resuscitation is needed.
- Health care workers: If you have exudative (draining) lesions, refrain from all direct patient care and from handling patient care equipment until wound is healed.
- Place laboratory specimens from all patients as if they are infectious (refer to agency manual).
- Use private rooms for patients with communicable diseases subject to airborne transmission or patients who soil their environment uncontrollably with body substances. For certain diseases (e.g., meningococcal meningitis), personnel and family entering the patient’s room are to wear masks. This is true for the first 24 hours until antibiotics have been started, then is no longer required per the CDC. Roommates who are immune to the patient’s disease or who are currently infected with the same disease are permitted to share rooms (institutional policy may vary on this specific procedure).


secretions, and excretions except sweat, regardless of whether or not they contain visible blood; (3) nonintact skin; and (4) mucous membranes. Standard precautions are designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infections (Box 12-5).

These precautions promote hand hygiene and use of gloves, masks, eye protection, and gowns when appropriate for patient contact.

**HAND HYGIENE**

Hand hygiene is the single most important and basic preventive technique for interrupting the infectious process. Box 12-6 indicates when it is essential to initiate hand hygiene.

**Box 12-6 Hand Hygiene Is Essential**

- When hands are visibly soiled
- Before and after caring for a patient
- After contact with organic material, such as feces, wound drainage, and mucus
- In preparation for an invasive procedure, such as suctioning, catheterization, or injections
- Before changing a dressing or having contact with open wounds
- Before preparing and administering medications
- After removing disposable gloves or handling contaminated equipment
- Before and after using the toilet
- Before and after eating
- At the beginning and end of the shift
Performing hand hygiene (Skill 12-1) will provide the necessary protection before you care for a patient. To effectively clean hands soiled with dirt or organic matter, or if you have handled a contaminated article, soap or detergents that contain antiseptic and water are required. The standard is to wash for 15 to 30 seconds using hospital approved soap, running hands under warm water (both cold and very hot water increase the risk of drying and chapping the skin). Box 12-7 contains an overview of the CDC hand hygiene guidelines, and Box 12-8 addresses the use of alcohol-based waterless antiseptics for hand hygiene. All forms of health care–associated infections can result from improper hand hygiene and use of contaminated equipment.

The CDC has pointed out the need for the health care worker in contact with patients to remove all artificial fingernails to maintain infection control principles (see Evidence-Based Practice box).

### Skill 12-1 Performing Hand Hygiene Using Soap and Water

**Nursing Action (Rationale)**

1. Inspect hands, observing for visible soiling, breaks, or cuts in the skin and cuticles. (*Poor personal hygiene and an open area of the skin provide areas in which microorganisms are able to grow.*)

2. Determine amount of contaminant of hands. (*Determines the type of hand hygiene needed.*)

3. Assess areas around the skin that are contaminated. (*Prevents contamination of hands during and after hand hygiene procedure.*)

4. Remove jewelry (except plain wedding band), and push watch and long sleeves above wrist. (*Microorganisms collect in jewelry and watch bands; removing jewelry makes it easier to wash all areas of hands and wrists.*)

5. Adjust the water to appropriate temperature and force. (*Water that is too hot or too cold can chap skin, and too much force will cause splashing and spread microorganisms to other areas, especially your clothing.*)

6. Wet hands and wrists under the running water, always keeping hands lower than elbows. (*Hands are the most contaminated part of the upper extremities; water should flow from the wrists [least contaminated area] over the hands, and then down the drain.*)

7. Lather hands with liquid soap (about 1 teaspoon). (*Soap lather emulsifies fat and aids in cleansing.*)

8. Wash hands thoroughly using a firm, circular motion and friction on back of hands, palms, and wrists. Wash each finger individually, paying special attention to areas between fingers and knuckles by interlacing fingers and thumbs and moving hands back and forth, causing friction (see illustration). (*Helps to loosen soil and microorganisms, both resident [normally present] and transient [acquired from contamination].*)

9. Wash for 15 to 30 seconds, rinse thoroughly, relather, and wash another minute, using continuous friction. (*Rinsing removes the loosened microorganisms, and relathering ensures more thorough cleaning. The greater the contamination, the more need for longer washing.*)

10. Rinse wrists and hands completely, again keeping hands lower than elbows (see illustration). (*Water should run from cleaner area [the wrists] over the hands, and then down the drain, rinsing the dirt and microorganisms away.*)

11. Clean fingernails carefully under running water, using fingernails of other hand or blunt end of an orange stick. (*Reduces chance of microorganisms remaining under nails.*)
12. Dry hands thoroughly with paper towels. Start by patting at fingertips, then hands, and then wrists and forearms. (Prevents chapping. Drying should progress from clean to less clean, and the cleanest areas are now your fingers and hands.)

13. Turn off faucets using a dry paper towel. (Keeps clean hands from touching contaminated handles.)

14. Use hospital-approved hand lotion if desired. (Keeps skin soft and lubricated so it will not crack easily.)

15. Inspect hands and nails for cleanliness. (Ensures cleanliness of hands and nails.)

16. If hands are not visibly soiled, use an alcohol-based waterless antiseptic for routine decontamination of hands in all clinical situations, unless you are caring for a patient with *Clostridium difficile* or *Candida* infection. The spores are impervious (incapable of being affected) to alcohol, so soap and water must be used in this instance. (See illustrations; also see Box 12-8.)

17. Do patient teaching (see Patient Teaching box on infection prevention and control).

18. Explain to the patient the importance of hand hygiene. (Helps the patient understand that hand hygiene slows down the spread of infection.)

19. If contamination continues, it is necessary to reassess technique.

Evidence-Based Practice

**Pathogens and Artificial Fingernails**

**Evidence Summary**
Female health care workers (HCWs) frequently have artificial or manicured nails. Researchers posed the question as to whether bacteria reside in higher than normal numbers on artificial nail material.

In three separate studies the identity and quantity of microbial flora from HCWs wearing artificial nails were compared with those from HCWs with normal nails. In both studies, nail surfaces were swabbed and subungual (area under nails) debris was collected to obtain material for culture. In the first study, 12 HCWs who did not normally wear artificial nails wore polished artificial nails on their nondominant hand for 15 days. Identity and quantity of microflora were compared between the artificial nails and the polished normal nails of the other hand. Potential pathogens were isolated from more samples obtained from artificial nails than normal nails. Colonization of artificial nails increased over time. More organisms were found on the surface of artificial nails than normal nails.

In the second study the flora of the nails of 30 HCWs who wore permanent acrylic artificial nails were compared with that of HCWs who did not wear artificial nails. HCWs wearing artificial nails were more likely to have a pathogen isolated than the other group.

In this study, artificial nails were more likely to harbor pathogens, especially gram-negative bacilli and yeasts, than normal nails. The longer artificial nails were worn, the more likely that a pathogen was isolated.

The third study examined an outbreak of *Pseudomonas aeruginosa* in a neonatal intensive care unit. This outbreak was attributed to two nurses. One nurse had long artificial nails, and another nurse had long natural nails. Both nurses carried on their hands the implicated strain of *P. aeruginosa*. The investigation found that the neonates were more likely to have been cared for by the two nurses during the exposure period. This indicated that the artificial and long natural nails may have contributed to causing this outbreak.

**Application to Nursing Practice**

- Nurses should not wear artificial nails or extenders when performing patient care (CDC, 2002).
- Natural nails should be kept well manicured at 1/4 inch long and free of nail gels and acrylic products.

**Reference**


Box 12-7 Overview of CDC Hand Hygiene Guidelines

The Centers for Disease Control and Prevention (CDC) makes recommendations for hand hygiene in health care settings. Hand hygiene is a term that applies to handwashing, use of an antiseptic hand rub, or surgical hand antisepsis. Evidence suggests that hand antisepsis, the cleansing of hands with an antiseptic hand rub, is more effective in reducing health care–associated infections than plain handwashing.

**FOLLOW THESE GUIDELINES IN THE CARE OF ALL PATIENTS**

- Continue practice of washing hands with either a nonantimicrobial or an antimicrobial soap and water whenever hands are visibly soiled.
- Use an alcohol-based hand rub to routinely decontaminate the hands in the following clinical situations: (Note: If alcohol-based hand rubs are not available, the alternative is handwashing.) (See Skill 12-1, Step 16.)
  - Before and after patient contact
  - Before donning sterile gloves when inserting central intravascular catheters
  - Before performing nonsurgical invasive procedures (e.g., urinary catheter insertion, nasotracheal suctioning)
  - After contact with body fluids or excretions, mucous membranes, nonintact skin, and wound dressings
  - If moving from a contaminated body site (rectal area or mouth) to a clean body site (surgical wound, urinary meatus) during patient care
  - After contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient
  - After removing gloves
- Before eating and after using a restroom, wash hands with soap (nonantimicrobial or antimicrobial) and water.
- Antimicrobial-impregnated wipes (i.e., towelettes) are not a substitute for using an alcohol-based hand rub or antimicrobial soap.
- If exposure to Bacillus anthracis is suspected or proven, wash hands with soap (nonantimicrobial or antimicrobial) and water. The physical action of washing and rinsing hands is recommended because alcohols, chlorhexidine, iodophors, and other antiseptic agents have poor activity against spores.

**FOLLOW THESE GUIDELINES FOR SURGICAL HAND ANTISEPSIS** (see Skill 12-6)

- Surgical hand antisepsis reduces the resident microbial count on the hands to a minimum.
  - The CDC recommends using an antimicrobial soap to scrub hands and forearms for the length of time recommended by the manufacturer. Refer to agency policy for time required.
  - When using an alcohol-based surgical hand-scrub product with persistent activity, follow the manufacturer’s instructions. Before applying the alcohol solution, prewash hands and forearms with a nonantimicrobial soap, and dry hands and forearms completely. After application of the alcohol-based product as recommended, allow hands and forearms to dry thoroughly before donning sterile gloves.

**GENERAL RECOMMENDATIONS FOR HAND HYGIENE**

- Use hospital-approved hand lotions or creams to minimize the occurrence of irritant contact dermatitis associated with hand antisepsis or handwashing.
- Do not wear artificial fingernails or extenders when having direct contact with clients at high risk (e.g., those in intensive care units or operating rooms).
- Keep natural nail tips less than 1/4 inch long.
- Wear gloves when contact with blood or other potentially infectious materials, mucous membranes, and nonintact skin could occur.
- Remove gloves after caring for a patient. Do not wear the same pair of gloves for the care of more than one patient, and do not wash gloves between uses with different patients.
- Change gloves during patient care if moving from a contaminated body site to a clean body site.


Box 12-8 Using an Alcohol-Based Waterless Antiseptic for Routine Hand Hygiene

The Centers for Disease Control and Prevention (CDC) (2002) recommends the use of alcohol-based waterless antisepsics to improve hand hygiene practices, protect health care workers’ hands, and reduce transmission of pathogens to patients and personnel in health care settings. Alcohols have excellent germicidal activity and are more effective than either plain soap or antimicrobial soap and water. Emollients are added to alcohol-based antisepsics to prevent drying the skin.

If hands are not visibly soiled, use an alcohol-based waterless antiseptic for routine decontamination of hands in most clinical situations.

1. Apply an ample amount of product to palm of one hand. (Enough product is needed to thoroughly cover the hands.)

2. Rub hands together, covering all surfaces of hands and fingers with antiseptic.

3. Rub hands together for several seconds until alcohol is dry. Allow hands to dry before applying gloves. If an adequate volume is used, it will take 15 to 25 seconds for hands to dry. (Drying ensures full antiseptic effect.)

4. If hands are dry or chapped, a small amount of lotion or barrier cream can be applied. (Use the hospital-provided container of lotion because other lotions will possibly interfere with antimicrobial action or disintegrate gloves.)


Note: Hand gels are not recommended if caring for a patient with Clostridium difficile (C. diff) diarrhea or Candida infections. The spores are impervious to the alcohol.
In addition to hand hygiene, there are other actions to take to reduce the chance of transmitting microorganisms. Teach patients and visitors about appropriate times for hand hygiene (see Patient Teaching box on infection prevention and control). Provide patients with their own set of personal care articles, such as bedpan, urinal, bath basin, water pitcher, and drinking glass, to prevent cross-contamination. Since microorganisms are also transmitted by indirect contact with contaminated equipment and soiled linen, place these articles in special waste containers or laundry bags and keep them away from your uniform.

The risk of transmitting health care–acquired infections or infectious disease among patients is high when standard precautions are not followed. Stay informed about patients who have a known source of infection, and alert other health care workers. By following recommendations for infection prevention and control practices, you and other health care workers will be protected from exposure and will lessen the risk of the patient acquiring a health care–associated infection.

**GLOVING**

Nurses and other health care personnel don gloves if there is any possibility of contact with infectious material. The CDC (Boyce & Pittet, 2002) gives the following advice regarding gloves:
- Wear gloves only once, and then place them into the appropriate waste containers for safe disposal.
- If you have not completed the patient’s care but have come into contact with infectious material, change the gloves before continuing the patient’s care.
- There is the risk of perforating the gloves during use, so perform hand hygiene after removing the gloves (Skill 12-2).

Family members need to understand the importance of using gloves. Explain that gloves become contaminated if they touch infected material or a contaminated object (see Patient Teaching box on gloving technique).

**Latex Allergy**

Latex allergy causes an individual to have a reaction to certain proteins found in natural rubber latex, a product manufactured from a milky fluid derived from the rubber tree found in Africa and Southeast Asia. The latex proteins are able to enter the body through the skin and mucous membranes, intravascularly, and by inhalation. Suspect the presence of latex allergy and obtain an evaluation by a physician when anyone, patient or health care worker, develops red, watery, itchy eyes; sinus or nasal tachycardia; and hypotension after exposure to latex. Anaphylaxis, a potentially life-threatening condition, sometimes occurs.

More than 20,000 medical products contain latex. Synthetic versions of many products are available. Even though an individual product is “latex free,” an environment is “latex safe” only when all items of latex that have potential to come in contact with the allergic individual are removed (Box 12-9).

Be alert to the possibility of other health care personnel or the patient being allergic to the latex gloves. Reactions vary from contact dermatitis to anaphylactic shock (see Chapter 24). When wearing latex gloves, ask patients if they have a known allergy to latex products before touching them. If they do, use nonlatex gloves. Make sure the fact is posted and passed along to all caregivers.

**Patient Teaching**

**Infection Prevention and Control**

- Teach the patient about the infection process, especially how an infection is transmitted, and stress the importance of interrupting the process. Use a simple diagram to illustrate this (see Figure 12-1). Teaching caregivers is extremely important as well.
- Use an example for each step that is familiar to the patient.
- Provide a simple explanation of clean as opposed to contaminated items.
- Although hand hygiene is a basic aseptic technique, stress when and how the procedure should be performed to be effective in preventing infection. Demonstrate hand hygiene within sight of the patient whenever possible.
- Instruct patient about signs and symptoms of wound infection.
- Teach the applications of aseptic principles to self-care activities such as wound care and medication administration.
- When isolation apparel (such as mask, gown, or gloves) is to be used, demonstrate the procedures for the patient and visitors.
- Instruct patient to place contaminated dressings and other disposable items containing infectious body fluids in leak-resistant bag. Place needles in bleach bottles with the cap taped or glued on, or place in a sharps container and take to local hospital for disposal.
- Always allow a question-and-answer session for the patient (some patients will need special assistance in understanding the precautions).

**Patient Teaching**

**Gloving Technique**

- Make certain the patient knows you are isolating the microorganism and not the patient.
- Some patients will need special assistance in understanding the precautions.
- Demonstrate to the patient how to don gloves.
Skill 12-2  Gowning

Nursing Action (Rationale)

Donning Gloves
1. Remove gloves from dispenser. (Keeps gloves handy and ready for use.)
2. Inspect gloves for perforations. (Prevents pathogenic microorganisms from entering through perforation in gloves.)
3. Don gloves when ready to begin patient care. Wearing gloves with a gown does not necessitate any special technique for putting them on; wear them pulled over cuffs of gown. (Ensures full coverage of your wrists.)
4. Change gloves after direct handling of infectious material such as wound drainage. (Prevents cross-contamination.)
5. Do not touch side rails, tables, or bed stands with contaminated gloves. (Prevents spread of microorganisms throughout environment.)

Removing Gloves
6. Remove first glove by grasping outer surface at palm with other gloved hand and pulling glove inside out and off (see illustration). Place this glove in the hand that is still gloved. (Prevents you from touching own skin with contaminated glove.)
7. Remove second glove by placing finger under cuff and turning glove inside out and over other glove (see illustration). Drop gloves into waste container. (Prevents you from touching contaminated glove. Wraps contamination inside gloves to help protect others.)
8. Perform hand hygiene. (Helps prevent cross-contamination.)
9. Do patient teaching (see Patient Teaching box on gloving technique).
10. If contamination continues, it is necessary to reassess technique.

Box 12-9 Preventing Latex Allergy

The American Nurses Association (ANA) provides the following suggestions for nurses to avoid becoming latex allergic:
1. Whenever possible, wear powder-free gloves (they are lower in protein allergens).
2. Wear gloves that are appropriate for the task (e.g., avoid use for cleaning).
3. Wash with a pH-balanced soap immediately after removing gloves.
4. Apply only non–oil-based hand care products (oil-based products break down latex).
5. If a reaction or dermatitis occurs, report to employee health and/or seek medical treatment immediately.

GOWNING

The use of a gown while administering care to a patient in isolation is important primarily to protect your clothing from being soiled. The gown also provides protection against infectious microorganisms possibly given off by the patient. It is recommended that you discard your gown when leaving the patient’s room rather than reuse it. This aids in preventing the spread of pathogens to other patients or personnel. This procedure also applies to visitors.

Another rationale for use of a gown is protection of a patient whose immune system is inadequate. In this situation, health care personnel and visitors wear a sterile gown to prevent the transfer of pathogens from themselves to the patient.
There are several types of isolation. Some necessitate wearing a gown, whereas others do not. Donning an isolation gown is indicated when caring for patients with diseases characterized by heavy drainage or exudate, infectious and acute diarrhea, other gastrointestinal disorders, respiratory disorders, skin wounds or burns, and urinary disorders.

Isolation gowns open at the back and have ties at the neck and the waist. This keeps the gown securely closed, protecting the back as well as the front of your uniform. It is necessary that the gown be long enough to cover your uniform and, for added protection, have long sleeves with cuffs.

To don gowns correctly, follow the procedure listed in Skill 12-3.

### Skill 12-3  Gowning for Isolation

**Nursing Action (Rationale)**

1. Remove your watch and push up long sleeves, if you have them. *(Ensures that uniform sleeve is under gown sleeve for protection.)*
2. Place your watch on a paper towel or in a see-through plastic bag before taking vital signs. *(Prevents cross-contamination.)*
3. Perform hand hygiene. *(Reduces spread of microorganisms.)*
4. Don gown and tie it securely at neck and waist (see illustrations). *(Provides protective covering of the entire uniform.)*
5. Remove gown after providing necessary patient care (see illustration). *(Has protected the nurse.)*

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**Step 4**

**Step 5**

*Continued*
**Skill 12-3  Gowning for Isolation—cont’d**

6. Discard soiled gown appropriately (see illustration). *(Prevents contamination.)*
7. Perform hand hygiene. *(Prevents spread of microorganisms.)*
8. Record use of gown in isolation procedure if agency’s policy so dictates. *(Provides proof that appropriate procedure was followed.)* Some agencies charge a daily rate for isolation precautions. This is noted on a daily basis in the patient’s record. Therefore repeated notations throughout the 24 hours are not necessary.
9. Do patient teaching (see Patient Teaching box on infection prevention and control).
10. If contamination continues, it is necessary to reassess technique.

**MASK AND PROTECTIVE EYEWEAR**

When a mask is correctly applied, it will fit snugly below your chin and securely over your nose and mouth, and the top edge will fit below your eyeglasses, if you wear them. *(This prevents fogging of your glasses.)* Masks are available with eyeshields like glasses to cover your eyes (or glasses). Goggles are another possible way to protect your eyes *(see Figure 12-5).* Change your mask at least every 20 to 30 minutes or if it becomes moist. Do not reuse a mask or allow it to dangle around your neck and then reuse it *(Skill 12-4).*

A mask is worn for the following reasons:
- To protect the wearer from inhaling microorganisms that travel on airborne droplets for short distances or that remain suspended in the air for longer periods, or if splashing should occur
- To prevent inhaling pathogens if resistance is reduced or if being transported to another area (patient wears mask)
- To discourage the wearer from touching the mouth, nose, or eyes and from transmitting infectious material

**DISPOSING OF CONTAMINATED EQUIPMENT**

Health care facilities generate immense quantities of contaminated materials, some of which are disposable and some of which are reusable. It is essential to design and implement an effective mechanism to handle this material within the facility. The disposal of contaminated materials also comes under the review of the infection preventionist and the infection prevention and control committee. Until the biowaste is removed from the property by the waste hauler, use of specially labeled (usually red) bagging is required for its removal from the nursing unit and storage in the medical waste storage area. A major risk to personnel is in the disposal of sharps (needles, blades), which are often contaminated by blood. When left in linens or in dressings, these have the potential to injure workers cleaning patient or resident care areas and examination rooms. To prevent this problem, it is necessary to provide all patient and resident care areas where sharps are ever used with puncture-proof containers into which health care workers place used disposable needles, syringes, and other sharps.

**DOUBLE BAGGING**

The CDC recommends double bagging *(an infection control practice that involves placing a bag of contaminated items into another, clean bag that is held outside an isolation room by other personnel)* when it is impossible to keep the outer surface of a single bag free from contamination. Label or color code the second bag to alert nursing personnel and to prevent contamination of housekeeping personnel who will handle the contaminated material. Use double bagging if necessary for safe removal of any article from the room.

The CDC recommends the following guidelines for handling isolation linen:
- Place soiled linen in a laundry bag in the patient’s room.
- Treat all linen as though it is infectious.
- Linen requires less handling if it is placed in a bag that is soluble in hot water; however, it is often necessary to double bag such a bag because it punctures or tears easily.

Note that double bagging is no longer recommended as a universal practice, unless a cloth bag is being placed in a plastic bag. In most cases, a single bag is
adequate if it is possible to place the contaminated articles in the bag without contamination of the outside of the bag.

**ISOLATION TECHNIQUE**

The CDC issued isolation guidelines, in addition to standard precautions, that contain two tiers of approach (Siegel et al., 2007). The first contains precautions designed to care for all patients in health care facilities regardless of their diagnosis or presumed infectiousness. This first tier is called **standard precautions**.

The second tier condenses the disease-specific and categories approach to isolation into new transmission categories: airborne, droplet, and contact precautions. These precautions are designed for specific patients with highly transmissible pathogens (Box 12-10, Figures 12-6 through 12-8).

The type of isolation techniques followed for a given patient will depend on how transmissible the pathogen in question is. Follow some basic principles regardless of which technique is used:

- Perform thorough hand hygiene before entering and after leaving a patient’s room.
- Use your understanding of the disease process and the method of transmission of the infectious microorganism to help determine which protective barriers to use.
- Dispose of contaminated equipment and articles in a safe and effective manner to prevent transmission of pathogens to other individuals.
- If the patient is to be transported to other areas in the agency (away from the isolation room), take necessary measures to protect those who will potentially be exposed. Transport the patient in accordance with hospital protocol.

Environmental barriers keep pathogens in a confined area. Examples of such barriers are a private or isolation room, closed door, protective gown, mask, goggles, and gloves.

Place the patient with an infectious disease in a private or isolation room equipped with the appropriate hand hygiene and toilet facilities. Private rooms used for airborne illness isolation have negative-pressure airflow that prevents infectious particulates from flowing out of the closed environment. Special rooms with positive-pressure airflow are also used for highly susceptible patients such as transplant recipients. In this
Box 12-10 Types of Precautions and Patients Requiring Those Precautions

STANDARD PRECAUTIONS (TIER 1)
Use standard precautions for the care of all patients. This general mandate is necessary because it is sometimes not known if the patient is colonized or infected with certain pathogenic microorganisms. Barrier precautions reduce the need to handle sharps.

TRANSMISSION PRECAUTIONS (TIER 2)
Airborne Precautions (see Figure 12-6)
In addition to standard precautions, use airborne precautions for patients known or suspected to have serious illnesses transmitted by airborne droplet nuclei. Examples of such illnesses include the following:
- Measles
- Varicella (including disseminated zoster)
- Tuberculosis

Droplet Precautions (see Figure 12-7)
In addition to standard precautions, use droplet precautions for patients known or suspected to have serious illness transmitted by large particle droplets. Examples of such illnesses include the following:
- Invasive Haemophilus influenzae, including meningitis, pneumonia, epiglottitis, and sepsis
- Invasive Neisseria meningitidis disease, including meningitis, pneumonia, and sepsis

Examples of other serious bacterial respiratory infections spread by droplet transmission include the following:
- Diphtheria (pharyngeal)
- Mycoplasma pneumonia
- Pertussis
- Pneumonic plague
- Streptococcal pharyngitis, pneumonia, and scarlet fever in infants and young children

Examples of serious viral infections spread by droplet transmission include the following:
- Adenovirus
- Influenza
- Mumps
- Parvovirus B19
- Rubella

Tuberculosis (TB) Isolation
- TB isolation should be practiced for all patients with known or suspected TB. (Suspected TB is defined by agency policy and generally means any patient with a positive acid-fast bacillus (AFB) smear, with a cavitating lesion seen on chest x-ray study, or identified as high risk by a screening tool.)
- Isolation is mandatory in a single-patient room designated as negative-pressure airflow and having at least 6 to 12 air exchanges per hour. It is necessary to vent room air to the outside and, to maintain negative pressure, to close the door.
- It is obligatory for health care workers to wear an N-95 or higher particulate respirator mask when entering an AFB isolation room (check agency’s policy for type of mask).
- It is obligatory for health care workers to be fit-tested before using a respirator for the first time. This ensures that the type and the size of the respirator is appropriate for the individual.
- It is obligatory for health care workers to fit-check the respirator’s fit before each use.
- Respirator is permitted to be reused and stored according to manufacturer’s recommendations and agency policy.

Contact Precautions (see Figure 12-8)
In addition to standard precautions, use contact precautions for patients known or suspected to have serious illnesses easily transmitted by direct patient contact or by contact with items in the patient’s environment. Examples of such illnesses include the following:
- Gastrointestinal, respiratory, skin, or wound infections or colonization with multidrug-resistant bacteria judged by the infection prevention and control committee, and current state, regional, and national recommendations, to be of special clinical and epidemiologic significance
- Enteric infections with a low infectious dose or prolonged environmental survival, including the following:
  a. Clostridium difficile
  b. Diapered or incontinent patients with the following:
     1. Escherichia coli O157:H7
     2. Shigella
     3. Hepatitis A
     4. Rotavirus
- Respiratory syncytial virus, parainfluenza virus, and entroviral infections in infants and young children
- Skin infections that are highly contagious or that tend to occur on dry skin, including the following:
  a. Diphtheria (cutaneous)
  b. Herpes simplex virus (neonatal or mucocutaneous)
  c. Impetigo
  d. Major (noncontaminated) abscesses, cellulitis, or decubitus ulcers
  e. Pediculosis
  f. Scabies
  g. Staphylococcal furunculosis in infants and young children
  h. Methicillin-resistant Staphylococcus aureus (MRSA)
     i. Vancomycin-resistant enterococci (VRE)
     j. Extended-spectrum beta-lactamase (ESBL) (Necessitates 9 months of contact precautions. This enzyme attaches to the cell wall of E. coli and some Klebsiella organisms, which in turn makes the organisms multidrug-resistant. Once treatment is completed, the enzyme is still found in the feces for up to 9 months.)
  k. Zoster (disseminated or in the immunocompromised host)
     l. Viral or hemorrhagic conjunctivitis
  m. Viral hemorrhagic infections (Ebola, Lassa, or Marburg)

Immunocompromised Patients
Immune compromised patients vary in their susceptibility to health care–associated infections depending on the severity and the duration of immunosuppression. They are generally at increased risk for bacterial, fungal, parasitic, and viral infections from both endogenous and exogenous sources. In general, the use of standard precautions for all patients and transmission-based precautions for specified patients reduces the acquisition by these patients of institutionally acquired organisms from other patients and environments. Leukopenic patients will sometimes require additional protective measures, other than standard precautions. In such instances, the physician or infection preventionist instructs nursing staff as to the necessary protective measures (e.g., masks, private room). They place an isolation sign on the door, which lists the additional protective measures that staff and visitors are required to follow for the safety of the patient.

Monitoring of Isolation
Transmission-based isolation practices are monitored on an ongoing basis by the infection preventionist.

†Fit-check: Procedure in which worker uses negative pressure to see if mask is properly sealed to face.
AIBLE PRECAUTIONS

(vis in addition to standard precautions)

VISITORS: Report to nurse before entering.

Use Airborne Precautions as recommended for patients known or suspected to be infected with infectious agents transmitted person-to-person by the airborne route (e.g., *M. tuberculosis*, measles, chickenpox, disseminated herpes zoster).

Patient placement

Place patients in an **AIR** (Airborne Infection Isolation Room). 
Monitor air pressure daily with visual indicators (e.g., flutter strips).

Keep door closed when not required for entry and exit.

In ambulatory settings instruct patients with a known or suspected airborne infection to wear a surgical mask and observe Respiratory Hygiene/Cough Etiquette. Once in an AIR, the mask may be removed.

Patient transport

Limit transport and movement of patients to medically-necessary purposes.

If transport or movement outside an **AIR** is necessary, instruct patients to wear a surgical mask, if possible, and observe Respiratory Hygiene/Cough Etiquette.

Hand Hygiene

Hand Hygiene according to standard precautions.

Personal Protective Equipment (PPE)

Wear a fit-tested NIOSH-approved N95 or higher level respirator for respiratory protection when entering the room of a patient when the following diseases are suspected or confirmed: Listed on back.

FIGURE 12-6 Airborne Precautions.
case, no organisms are able to enter the room. The routine care of a patient in isolation follows from the same hygienic principles as the care given to all patients. Remember that all articles that come into contact with the patient are contaminated, and handle them appropriately to maintain asepsis. Dedicated equipment for assessing vital signs remains in the room if possible. Otherwise it is mandatory to safely disinfect the equipment when you remove it from the room.

It is important in the care of the patient to consider the psychological or emotional deprivation that will possibly result from transmission-based isolation precautions. The patient is forced into solitude and deprived of normal social contacts. Proper care of the patient will make him or her feel wanted and cared for like all other patients. Spend extra time with the patient, keep the room clean and pleasant, and teach the patient the rationale for the precautions. The patient’s emotional state has the potential to interfere with recovery, so make every effort to keep feelings of psychological and physical isolation to a minimum. Make sure the patient and significant others have an under-
standing of the patient’s disease and know the importance of following the precautions. Teach family and visitors how to wear isolation apparel, and ensure that the procedure is followed (Skill 12-5).

PULMONARY TUBERCULOSIS (TB) PRECAUTIONS

The dramatic upsurge in the incidence of pulmonary TB, in some cases involving multidrug-resistant strains of the microorganism, has increased concern regarding health care–associated transmission. Guidelines for preventing pulmonary TB in health care settings stress the importance of early identification and treatment of people with known or suspected TB and proper isolation in the health care setting. Suspect the presence of pulmonary TB in any patient with respiratory symptoms lasting longer than 3 weeks. Good assessment skills hasten the possibility of a diagnosis, which is essential, because the risk of exposure is greatest before a diagnosis is made and isolation precautions are implemented. Suspicious symptoms include fatigue, unexplained weight loss, dyspnea, fever, night
Skill 12-5  Isolation Technique

Nursing Action (Rationale)
1. Determine causative microorganism and effectiveness of patient’s immune system. (Determines virulence of causative pathogen.)
2. Recognize mode of transmission and how microorganism exits the body. (Determines the category or type of isolation to use.)
3. Follow agency policy for specific type of transmission-based isolation used. (Increases awareness of isolation categories available in the agency.)
4. Ensure that the environment has the equipment and supplies for the type of isolation:
   a. Private or isolation room with anteroom. (Reduces spread of pathogens.)
   b. Adequate hand hygiene facilities. (All workers and visitors are to perform hand hygiene before entering and leaving the area.)
   c. Containers for trash, soiled linen, and sharp instruments, such as needles. (Ensures safe disposal of contaminated articles.)
5. Provide explanation of isolation technique to patient, family, and visitors. (Relieves apprehension and promotes cooperation of those involved.)
6. Post sign on door of patient’s room or wall outside room stating the protective measures in use for patient care. (Informs personnel, patient, family, and visitors entering room of precautions to be followed and encourages cooperation.)
7. Be certain to supply the room with lined containers designated for soiled linens and for trash. (Prevents transmission of pathogens from seepage through container.)
8. Assess vital signs, administer medications, administer hygiene, and collect specimens (Table 12-3). (Administers patient care.)
9. Report changes in patient’s health status, whether positive or negative, to primary health care provider or supervisor. (Ensures continued care and helps determine patient progress.)
10. Record assessments and performance of transmission-based isolation precautions. (Provides proof of appropriate patient care.) Document per agency policy.
11. Determine patient’s understanding of activities in room. (Increases patient’s comfort and feeling of well-being.)
12. Provide patient teaching (see Patient Teaching box on infection prevention and control).
13. Additional techniques for acid-fast bacillus (AFB) isolation:
   a. Before entering room, don N-95 respirator mask that you have been fit-tested for. (Reduces transmission of airborne droplet nuclei.)
   b. Explain purpose of AFB to patient, family, and others. (Improves ability of patient to participate in care. It is not possible to transmit TB through contact with clothing, bedding, food, or eating utensils.)
   c. Explain to patient that TB is transmitted by inhalation of droplets that remain suspended in the air when patient coughs, sneezes, or speaks (CDC, 2006). Offer opportunity for questions. (Improves ability of patient to participate in care.)
   d. Instruct patient to cover mouth with tissue when coughing, to perform hand hygiene, and to wear disposable surgical mask when leaving the room. (Reduces spread of droplet nuclei.)
   e. Do not place the N-95 particulate respirator that you or other health care workers wear on the patient or visitors. The added work of breathing through the respirator is an added stress on an already compromised pulmonary system. Simply apply a regular surgical mask. (Reduces the spread of droplet nuclei.)
      • Provide care.
      • Leave the room and close the door. (Maintains negative pressure in room.)
      • Remove respiratory protective device last. (Most fitted respiratory devices are reusable.)
      • Place reusable device in labeled paper bag for storage, being careful not to crush device. (Plastic bags seal in moisture.) (Check agency policy for number of times it can be reused.)
      • Record assessments and performance of patient care. (Promotes continuity of care.)

sweats, and hemoptysis (a cough that can be productive of blood). Isolation for patients with known or suspected TB includes a negative-pressure isolation room (see Box 12-10). Such rooms have negative pressure in relation to surrounding areas in the facility so that room air is exhausted directly to the outside, or through special high-efficiency particulate air (HEPA) filters if recirculation is unavoidable. High-hazard procedures on patients with suspected or confirmed infectious TB must be performed in negative-pressure rooms.

OSHA and CDC guidelines require health care workers who care for active or suspected TB patients to wear HEPA respirators (Jensen et al., 2005; United States Department of Labor, 2009). The respirators have the capacity to filter particles smaller than 5 μm in size with a filter efficiency of 95% or higher. It is mandatory to fit-test the masks of health care employ-
ees who work in the rooms of TB patients in a reliable way to obtain a face-seal leakage of 10% or less. Under National Institute for Occupational Safety and Health (NIOSH) criteria, the minimally acceptable level of respiratory protection for TB is the N-95 respirator (see Skill 12-5). Training in the wearing and storage of the respirator is required for hospital staff. OSHA also requires employers to provide training concerning transmission of TB, especially in areas where risk of exposure is high, such as in bronchoscopy proce-
absence of all microorganisms, including pathogens and spores, from an object. It is essential that you understand that the slightest break in technique, when you are working with a sterile field or with sterile equipment, results in contamination. Practice surgical asepsis (e.g., when filling a syringe or changing a dressing on a wound) to keep microorganisms away from an area.

Although surgical asepsis is practiced in the operating room, the labor and delivery area, and major diagnostic or procedure areas, you will also sometimes use surgical aseptic techniques at the patient's bedside. This includes, for example, when you insert IVs or urinary catheters, suction the tracheobronchial airway, and reapply sterile dressings. In an operating room, follow a series of steps to maintain sterile techniques, including donning a mask, protective eyewear, and a cap; performing surgical hand hygiene; and donning a sterile gown and gloves. In contrast, when you are changing a dressing at a patient's bed-

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**Box 12-11 Principles of Sterile Technique**

1. **A sterile object remains sterile only when touched exclusively by other sterile objects.** (This principle guides your placement of sterile objects and how you handle them.)
   a. Sterile touching sterile remains sterile; for example, wear sterile gloves and use sterile forceps to handle objects on a sterile field.
   b. Sterile touching clean becomes contaminated; for example, if the tip of a syringe or other sterile object touches the surface of a clean disposable glove, the object is contaminated.
   c. Sterile touching contaminated becomes contaminated; for example, when you touch a sterile object with an ungloved hand, the object is contaminated.
   d. Sterile touching questionable is contaminated; for example, when you find a tear or break in the covering of a sterile object, discard the object regardless of whether it appears untouched or not.

2. **Place only sterile objects on a sterile field.** Properly sterilize all items before use. It is essential to keep the package or container holding a sterile object intact and dry. A package that is torn, punctured, wet, or open is unsterile.

3. **A sterile object or field out of the range of vision or an object held below a person’s waist is contaminated.** Never turn your back on a sterile tray or leave it unattended. It is possible for contamination to occur accidentally from a dangling piece of clothing, falling hair, or an unknowing patient touching a sterile object. Consider any object below waist level contaminated since you are not able to keep it in constant view. Keep sterile objects in front of you with your hands as close together as possible.

4. **A sterile object or field becomes contaminated by prolonged exposure to air.** Avoid activities that potentially create air currents, such as excessive movements or rearranging linen after a sterile object or field becomes exposed. When opening sterile packages, it is important to keep to a minimum the number of people walking into the area. Microorganisms also travel by droplets through the air. Make sure no one talks, laughs, sneezes, or coughs over a sterile field or when gathering and using sterile equipment. Never perform sterile procedures if you have a cold or other respiratory ailment unless you are wearing a specialized mask. Microorganisms have the potential to travel through the air and fall on sterile items or fields if you reach over the work area. When opening sterile packages, hold the item or piece of equipment as close as possible to the sterile field without touching the sterile surface. Keeping movement and rearranging of sterile items to a minimum also reduces contamination by air transmission.

5. **When a sterile surface comes in contact with a wet, contaminated surface, the sterile object or field becomes contaminated.** Moisture seeping through a sterile package's protective covering permits microorganisms to travel to the sterile object. When stored sterile packages become wet, discard the objects immediately or send the equipment for resterilization. When working with a sterile field or tray, you will sometimes have to pour sterile solutions. Any spill is a possible source of contamination unless the object or field rests on a sterile surface impervious to moisture. For example, urinary catheterization trays contain sterile supplies that rest in a sterile, plastic container. Any sterile solutions spilled within the container will not contaminate the catheter or other objects. In contrast, if you place a piece of sterile gauze in its wrapper on a patient’s bedside table and the table surface is wet, consider the gauze to be contaminated.

6. **Fluid flows in the direction of gravity.** A sterile object becomes contaminated if gravity causes a contaminated liquid to flow over the object's surface. To prevent contamination during a surgical hand scrub, raise and hold your hands above your elbows. This allows water to flow downward without contaminating your hands and fingers. The principle of water flow by gravity is also the reason for drying in a sequence from fingers to elbows, with hands held up, after the scrub (see Skill 12-6).

7. **Consider the edges of a sterile field or container to be contaminated.** Frequently, you will place sterile objects on a sterile towel or drape. Because the edge of the drape touches an unsterile surface, such as a table or bed linen, it is necessary to consider a 1-inch (2.5-cm) border around the drape to be contaminated. The edges of sterile containers become exposed to air after they are open and are thus contaminated. After you remove a sterile needle from its protective cap or after removing a forceps from a container, do not allow the objects to touch the container's edge. The lip of an opened bottle of solution also becomes contaminated after it is exposed to air. When pouring a sterile liquid, first pour a small amount of solution and discard it. The solution thus washes away microorganisms on the bottle lip. Then pour a second time on the same side to fill a container with the desired amount of solution.
Because surgical asepsis requires exact techniques, you will need the patient’s cooperation. For this reason, prepare the patient before any procedure. Certain patients fear moving or touching objects during a sterile procedure, whereas others will even try to assist. Explain how a procedure is to be performed and instruct the patient how to avoid contaminating sterile items, including the following measures:

- Try not to make sudden movements of body parts covered by sterile drapes
- Refrain from touching sterile supplies, drapes, or the nurse’s gloves and gown
- Avoid coughing, sneezing, or talking over a sterile area

**PRINCIPLES OF STERILE TECHNIQUE**

When beginning a surgically aseptic procedure, follow the principles listed in Box 12-11 to ensure maintenance of asepsis. Failure to follow each principle conscientiously endangers patients, placing them at risk for infection.

Assemble all the equipment necessary for a sterile procedure before the procedure begins. By doing so, you avoid the need to leave a sterile area unattended because some equipment is missing. Have a few extra supplies available in case objects accidentally become contaminated. If an object becomes contaminated during the procedure, discard it immediately.

**SURGICAL HAND SCRUB**

In the operating room setting, effective handwashing or use of select surgical hand rub to achieve surgical hand hygiene is imperative. To reduce patients’ risk of postoperative infection, use an antimicrobial preparation for hand hygiene as an integral part of the presurgical scrubbing procedure for operating room personnel. Although it is not possible to sterilize the skin, it is possible to greatly reduce the number of microorganisms by chemical, physical, and mechanical means.

The surgical hand scrub (Skill 12-6) is the traditional method for surgical asepsis. Through the use of an antimicrobial agent and sterile brushes, the surgical hand scrub removes debris and transient microorganisms from the nails, the hands, and the forearms; reduces the resident microbial count to a minimum; and inhibits rapid or rebound growth of microorganisms. New evidence suggests that a brushless technique with an agent containing at least 60% alcohol, with or without water, has the same microbial efficacy and provides an alternative to the traditional hand scrub.

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**Skill 12-6  Surgical Hand Hygiene**

**Nursing Action (Rationale)**

1. Inspect hands for presence of abrasions, cuts, or open lesions. (These conditions increase likelihood of more microorganisms residing on skin surfaces.)
2. Apply surgical shoe covers, cap or hood, face mask, and protective eyewear. (Mask prevents escape into air of microorganisms that can contaminate hands. Other protective wear prevents exposure to blood and body fluid splashes during the procedure.)
3. Perform surgical hand hygiene (traditional method):
   a. Turn on water using knee or foot controls and adjust to comfortable temperature.
   b. Wet hands and arms under running lukewarm water and lather with detergent to 5 cm (2 inches) above elbows. (Keep hands above elbows at all times.) (Hands become cleanest part of upper extremity. Keeping hands elevated allows water to flow from least to most contaminated areas, since water runs by gravity from fingertips to elbows. Washing a wide area reduces risk of contaminating gown that you will don later.)
   c. Rinse hands and arms thoroughly under running water. REMEMBER TO KEEP HANDS ABOVE ELBOWS. (Rinsing removes transient microorganisms from fingers, hands, and forearms.)
   d. Under running water, clean under nails of both hands with nail pick. Discard after use (see illustration). (Removes dirt and organic material that harbor large numbers of microorganisms.)
   e. (1) Wet clean sponge and apply antimicrobial detergent. Scrub nails of one hand with 15 strokes. Holding sponge perpendicular to hand (see illustration) scrub palm, each side of thumb and fingers, and posterior side of hand with 10 strokes each.

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**Step 3d**

Continued
Skill 12-6  Surgical Hand Hygiene—cont’d

(2) Mentally divide your arm into thirds, and scrub each third 10 times (see illustration). Entire scrub should last 5 to 10 minutes. Rinse sponge and repeat sequence for other arm. It is permitted to substitute with a two-sponge method. Check agency policy. (Friction loosens resident bacteria that adhere to skin surfaces. Ensures coverage of all surfaces. Scrubbing is performed from cleanest area [hands] to marginal area [upper arms].)

f. Discard sponge and rinse hands and arms thoroughly (see illustration). Turn off water with foot or knee control and back into room entrance with hands elevated in front of and away from the body. (After touching skin, consider sponge contaminated. Rinsing removes resident bacteria. Prevents accidental contamination.)

g. (1) Walk up to sterile tray and lean forward slightly to pick up a sterile towel (see illustration).

(2) Dry one hand thoroughly, moving in sequence from fingers to elbow. Dry in a rotating motion. Dry from cleanest to least clean area (see illustration). (Drying prevents chapping and facilitates donning of gloves. Leaning forward prevents accidental contact of arms with scrub attire.)

h. Repeat drying method for other hand by carefully reversing towel or using a new sterile towel. (Prevents accidental contamination.)
i. Discard towel. (Prevents accidental contamination.)

j. Proceed with sterile gowning.

4. Alternate method of surgical hand hygiene using alcohol-based antiseptic:
   a. Wash hands with soap and water for 15 to 30 seconds to remove soil. (Removes dirt and organic material that harbor large numbers of microorganisms.)
   b. Under running water, clean under nails of both hands with nail pick. Discard after use and dry hands with a paper towel. (Removes dirt and organic material that harbor large numbers of microorganisms.)

   c. Apply enough alcohol-based waterless antiseptic to one palm to cover both hands thoroughly. Spread the antiseptic over all surfaces of the hands and the fingernails. Follow product instructions for length of time to rub over hand surfaces. Allow to air-dry. (Ensures coverage of all surfaces. Air-drying ensures complete antisepsis.)

   d. Repeat the process and allow hands to air-dry before applying sterile gloves.

with a brush. Both hand antiseptic methods are currently used in operating room settings. Skill 12-6 addresses both techniques.

Surgical personnel wear surgical attire (i.e., scrubs) in the operating room to reduce the chance for contamination from themselves to patients and vice versa. Fingernails should be short, clean, and healthy. If you wear polish, make sure it is not chipped and not older than 4 days. Do not wear artificial nails. Artificial nails tend to harbor gram-negative microorganisms and fungus. Remove all rings, watches, and bracelets before the surgical scrub.

The Association of Perioperative Registered Nurses (AORN) (2005) has a revised set policies and procedures; also refer to agency policy on surgical hand hygiene (see Chapter 2 of Adult Health Nursing).

MANAGING STERILE PACKAGES
Sterile items such as syringes, gauze dressings, and catheters are packaged in paper or plastic containers that are impervious (unable to be penetrated) to microorganisms as long as they are dry and intact. Some institutions wrap reusable supplies in a double thickness of linen or muslin. Paper packages are permeable to steam and thus allow for steam autoclaving. A disadvantage of paper wrappers is that they tear or puncture relatively easily. Place sterile items in clean, enclosed storage cabinets, and never keep them in the same room as dirty equipment.

Sterile supplies have dated labels or chemical tapes that indicate the date when the sterilization expires. The tapes change color during the sterilization process. Failure of the tapes to change color means the item is not sterile. Never use or allow use of a sterile item or piece of equipment after the expiration date. Some agencies use the “event-related” contamination rule. If the integrity of the sterile package is questionable (i.e., wet, torn, discolored), the item is not used. If you find moisture after opening a sterile tray, either discard the item or return it to the institution’s supply area for resterilization.

Before opening a sterile item, perform thorough hand hygiene. Assemble the supplies at the work area, such as the bedside table or in the treatment room, before opening packages. A bedside table or countertop provides a large, clean working area for opening items. Make sure the work area is above your waist level. Do not open sterile supplies in a confined space where it is possible for a dirty object to fall on or strike them.

It is possible to open sterile packaged items without contaminating the contents even when you are not wearing sterile gloves. Commercially packaged items are usually designed so that you only have to tear away or separate the paper or plastic cover. Hold the item in one hand while pulling the wrapper with the other (Figure 12-9, A). Take care afterwards to keep the inner contents sterile before use. When opening items packed in linen and some commercially prepackaged items, use the steps described in Box 12-12 and illustrated in Figure 12-9, B through E, and Figure 12-10.

PREPARING A STERILE FIELD
When performing sterile procedures, you need a sterile work area that provides room for handling and placing of sterile items. A sterile field is an area that is free of microorganisms and is prepared to receive sterile items. Prepare the field by using the inner surface of a sterile wrapper as the work surface or by using a sterile drape (Skill 12-7).

Sometimes you will choose to wear sterile gloves while preparing items on the field. You are then able to touch the entire drape, but an assistant will have to open and pass sterile items to you. Do not allow your gloves to touch the outside wrappers of sterile items.

POURING STERILE SOLUTIONS
Often you will be called on to pour sterile solutions into sterile containers. A bottle containing a sterile solution is sterile on the inside and contaminated on the outside. The bottle’s neck is also contaminated, but the inside of the bottle cap is sterile. After opening a cap or lid, hold it in your hand or place it, sterile side (inside) up, on a clean surface. This means that you can see the inside of the lid as it rests on the table surface. Never allow a bottle cap or lid to rest sterile side down on a
FIGURE 12-9  A, When opening a commercially packaged sterile item, tear the wrapper away from your body. B, When opening sterile packaged items on a flat surface, open the top flap away from your body. C, Keep your arm out, away from the sterile field, while opening the side flap. D, Opening the second side flap. E, Opening the back flap.

1. Perform hand hygiene.
2. Place the item flat in the center of the work surface.
3. Remove the tape or seal indicating the sterilization date.
4. Grasp the outer surface of the tip of the outermost flap.
5. Open the outer flap away from your body, keeping your arm outstretched and away from the sterile field.
6. Grasp the outside surface of the first side flap.
7. Open the side flap, allowing it to lie flat on the table surface. Keep your arm to the side and not over the sterile surface. Do not allow flaps to spring back over the sterile contents.
8. Grasp the outside surface of the second side flap and allow it to lie flat on the table surface.
9. Grasp the outer surface of the last and innermost flap.
10. Stand away from the sterile package and pull the flap back, allowing it to fall flat on the surface.
11. Use the inner surface of the package cover (except for the 1-inch border around the edges) as a sterile field to handle this or additional sterile items (see Figure 12-10). Grasp the 1-inch border to maneuver the entire field on the table surface.
12. When opening a small, sterile item, hold it in your hand so that you can pass it to a person wearing sterile gloves or transfer it to a sterile field. Hold the package in your nondominant hand while you open the top flap and pull it away from you. Using your dominant hand, carefully open the side and top flaps away from the enclosed sterile item in the same order in the earlier steps (see Figure 12-10).
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**Skill 12-7   Preparing a Sterile Field**

**Nursing Action (Rationale)**

1. Prepare sterile field just before planned procedure. *(Prevents exposure of sterile field and supplies to air contamination.)* Make sure to use supplies immediately.
2. Select clean work surface that is above waist level. *(Consider sterile objects held below waist contaminated.)*
3. Assemble necessary equipment. *(Preparing equipment in advance prevents breaks in technique.)*
   - Sterile drape
   - Assorted sterile supplies
4. Check dates, labels, and condition of package for sterility of equipment. *(Consider equipment stored beyond expiration date, or a package that is damaged, unsterile.)*
5. Wash hands thoroughly. *(Prevents spread of microorganisms.)*
6. Place pack containing sterile drape on work surface and open (see Figure 12-9). *(Ensures sterility of packaged drape.)*
7. With fingertips of one hand, pick up folded top edge of sterile drape. *(Up to the 1-inch border around drape is unsterile and permitted to be touched.)*
8. Gently lift drape up from its outer cover and let it unfold by itself without touching any object. Discard outer cover with your other hand. *(If sterile object touches any unsterile object, it becomes contaminated.)*
9. With other hand, grasp adjacent corner of drape and hold the entire edge straight up and away from your body. Now, properly place drape while using two hands and making sure to keep the drape away from unsterile surfaces. *(Prevents contamination.)*
   - a. Holding drape, first position the bottom half over intended work surface. *(Prevents you from reaching over sterile field.)*
   - b. Allow top half of drape to be placed over work surface last. *(Creates a flat, sterile work surface.)*
10. Perform procedure using sterile technique. *(Prevents contamination.)*

Pour any solution slowly to avoid splashing the underlying drape or field. Never hold the bottle so high above the recipient container that even, slow pouring will cause splashing. Hold the bottle outside the edge of the sterile field (Figure 12-11).

**DONNING STERILE GOWN**

It is necessary to don a sterile gown (Skill 12-8) before working in the operating room, as well as before assisting with certain sterile procedures or working in special treatment areas. The sterile gown decreases the risk of contaminating sterile objects when you handle them. In addition, the sterile gown prevents contami-

sterile surface because the cap’s outer edge is unsterile and will contaminate the surface. Likewise, placing a sterile cap down on an unsterile surface increases the chances of the inside of the cap becoming contaminated.

Hold the bottle with its label in the palm of your hand to prevent the solution from wetting the label and causing it to fade. Before pouring the solution into the container, “lip” the bottle by pouring a small amount (1 to 2 mL) into a disposable cup or plastic-lined waste receptacle, and discarding it. The poured solution cleans the lip of the bottle. Keep the edge of the bottle from touching from the edge or the inside of the receiving container, which is unsterile.

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**FIGURE 12-10** Placing items on a sterile field.

**FIGURE 12-11** Place receptacle into which you pour fluids near edge of sterile table to prevent the need for reaching over sterile field to pour.
nation of sterile objects or fields by microorganisms shed from your skin (Potter & Perry, 2006).

DONNING STERILE GLOVES
Sterile gloves are an additional barrier to bacterial transfer. There are two methods of donning gloves: open (Skill 12-9) and closed (Figure 12-12). Nurses who work on general nursing divisions use open gloving before procedures such as dressing changes or urinary catheter insertions. Use the closed gloving method when donning a sterile gown before procedures in the operating room and special treatment areas.

Make sure to select the proper glove size. It is necessary for the glove to be snug enough for you to pick things up easily, and yet not so tightly stretched that it tears easily.

 Skill 12-8 Donning a Sterile Gown

**Nursing Action (Rationale)**

1. Don surgical cap, shoe covers, protective eyewear, and mask, and then perform surgical hand hygiene. (Prevents contamination of the surgical field as well as protects the nurse from blood and body fluid exposure.)

2. Ask the circulating nurse to open the sterile gown package and the sterile glove package. (Prevents you from contaminating your own hands following the surgical handwash since the outer wraps are not sterile.)

3. Don the gown.
   a. If available, the scrub nurse will assist by pulling the gown over your extended hands and arms. If there is no assistance from a scrub nurse:
      (1) Pick up the gown touching only the inner surface below the neck. (Touching the outer, sterile surface causes the gown to become contaminated since your hands are not yet gloved and thus unsterile.)
      (2) Maintain constant control of the folded layers of the gown. (Prevents the gown from brushing against unsterile surfaces.)
      (3) While holding the gown at arm’s length, allow the gown to unfold from top to bottom. Be sure that the gown does not touch the floor (see illustration). (Prevents contamination.)
      (4) While holding the inside of the gown near the shoulders and below the neckband, slide hands and arms into the sleeves with your fingers stopping at the end of the cuffs (see illustration). (The fingers remain inside the sleeves in order to don the sterile gloves by means of closed gloving.)
      (5) Ask another staff member to grasp the cord that is attached to the ties of the gown in order to draw the ties around to the back with the gown overlapping itself. The staff member should now tie the gown, avoiding touching any part of the gown except the ties. (Do not allow the front or the sides of the gown to be touched by the staff member since these areas are sterile.)
FIGURE 12-12 Closed gloving. A, Open glove package. B, Grasp back of dominant hand’s glove cuff with nondominant hand and stretch over end of dominant hand’s sleeve. C, Glove nondominant hand in same manner. D, Use gloved dominant hand to pull on glove, keeping nondominant hand inside sleeve until it emerges into glove.

Skill 12-9 Performing Open Sterile Gloving

Nursing Action (Rationale)

1. Have package of properly sized sterile gloves at treatment area. (Facilitates procedure.)
2. Perform thorough hand hygiene. (Removes bacteria from skin surfaces.)
3. Remove outer glove package wrapper by carefully separating and peeling apart sides (see illustration). (Prevents inner glove package from accidentally opening and touching contaminated objects.)
4. Grasping inner side of package, lay package on clean, flat surface just above waist level. Open package, keeping gloves on wrapper’s inside surface (see illustration). (Inner surface of glove package is sterile. Sterile objects held below the waist are considered contaminated.)
5. Identify right and left gloves. Each glove will have cuff approximately 2 inches (5 cm) deep. (Proper identification of gloves prevents contamination by improper fit.)
6. Glove dominant hand first. With thumb and first two fingers of nondominant hand, grasp edge of cuff of glove for dominant hand. Touch only
Skill 12-9  Performing Open Sterile Gloving—cont’d

glove’s inside surface (see illustration). (Gloving of dominant hand first improves dexterity. Touching inside surface is permitted since inner edge of cuff will lie against skin. If glove’s outer surface touches hand or wrist, it is contaminated.)

7. Carefully pull glove over dominant hand, leaving cuff; make sure cuff does not roll up wrist. Make sure thumb and fingers are in proper spaces (see illustration). (If glove’s outer surface touches hand or wrist, it is contaminated.)

8. With gloved, dominant hand, slip fingers underneath second glove’s cuff in such fashion that the cuff will protect the gloved fingers (see illustration). (Sterile touching sterile prevents glove contamination.)

9. Carefully pull second glove over nondominant hand. Do not allow fingers and thumb of gloved, dominant hand to touch any part of exposed nondominant hand. Keep thumb of dominant hand abducted back (see illustration). (Contact of gloved hand with exposed hand results in contamination.)

10. After second glove is on, interlock hands. Be sure to touch only sterile sides. The cuffs usually fall down after application (see illustration). (Ensures smooth fit over fingers.)
Closed Gloving

Closed gloving is practiced when the nurse wears a sterile gown. To perform the closed gloving procedure, keep your hands covered with the gown sleeves as you open the inner sterile glove package. As with open gloving, you will glove the dominant hand first. With your nondominant hand inside the gown cuff, pick up the glove for your dominant hand by grasping the folded cuff through the gown material. Extend your dominant forearm palm up and place the palm of the glove against the palm of your dominant hand. Glove fingers will point toward elbow.

Grasp the back of the glove cuff with your nondominant hand, still through the gown material, and turn the glove cuff over the end of your dominant hand and the gown cuff (Figure 12-12, B). Grasp the top of the glove and the underlying gown sleeve with your covered, nondominant hand. Carefully extend fingers of your dominant hand into the glove, making sure the glove’s cuff covers the gown’s cuff. Then go on to glove your second, nondominant hand in the same manner, reversing hands (Figure 12-12, C). Use your gloved, dominant hand to pull on the nondominant hand’s glove, once again keeping your hand inside the gown sleeve (Figure 12-12, D) until you are able to extend it out of the sleeve and directly into the glove.

By the use of this closed gloving procedure, you maintain the sterile barrier and prevent contamination. You are now ready to assist with sterile materials and instruments such as those called for during surgery or treatments such as wound debridement.

CLEANING, DISINFECTION, AND STERILIZATION

Pathogenic microorganisms are present on most articles in the home and public areas, including health care agencies. By following basic clean or aseptic technique, you are able to interrupt the spread of infection. Antiseptics are a means to inhibit the growth of microorganisms, although killing them this way is not possible. Antiseptics are also referred to as bacteriostatic solutions. Bacterio means “microorganism” and static means “referring to that which cannot move or grow.” Use of antiseptics on human tissue is acceptable and is often performed before surgery, during wound care, for mouth care, and for washing hands.

CLEANING

Cleaning is the removal of foreign materials, such as soil and organic material, from objects. Generally, cleaning involves use of water and mechanical action with or without detergents.

When an object comes in contact with infectious or potentially infectious material, the object is contaminated. If the object is disposable, it is usually discarded unless formal policies and procedures are in place for reprocessing the object. It is necessary to thoroughly clean reusable objects and then either disinfect or sterilize them before reuse.
When cleaning equipment that is soiled by organic material such as blood, fecal matter, mucus, or pus, put on a mask and protective eyewear or goggles (see Figure 12-5) (or a face shield) and waterproof gloves. These barriers provide protection from infectious organisms (as discussed earlier). You will need a stiff-bristled brush and detergent or soap for cleaning. The following steps ensure that an object is clean:

1. Rinse a contaminated object or article with cold running water to remove organic material. Hot water causes the protein in organic material to coagulate and stick to objects, making removal difficult.
2. After rinsing, wash the object with soap and warm water. Soap or detergent reduces the surface tension of water and emulsifies dirt and remaining material. Rinse the object thoroughly to remove the emulsified dirt.
3. Use a brush to remove dirt or material in grooves or seams. Friction dislodges contaminated material for easy removal. Open any hinged items for cleaning.
4. Rinse the object in warm water.
5. Dry the object and prepare it for disinfection or sterilization if indicated by the intended use of the item.
6. Consider the brush, the gloves, and the sink in which the equipment is cleaned contaminated and make sure it is cleaned and dried per hospital protocol.

**DISINFECTION**

Disinfection is used to destroy microorganisms. However, it does not destroy spores. The solutions used are called disinfectants, or possibly bactericidal solutions (the suffix -cidal is derived from a Latin word meaning “to kill”). These solutions are too strong for human skin to tolerate and are used only on inanimate objects. If a disinfectant solution comes in contact with human tissue, the tissue will feel “slippery.” This is the first step of tissue breakdown. When using a disinfectant solution, use clean gloves to protect your skin (Skill 12-10).

**STERILIZATION**

Sterilization refers to methods used to kill all microorganisms, including spores. There are two types of sterilization methods: physical and chemical (Box 12-13).

Most health agencies have a central supply department that disinfects and sterilizes reusable equipment and supplies. Although most supplies used today for patient care are disposable, some situations still require the use of disinfection and sterilization techniques. Teach the patient and significant others principles of cleansing and disinfecting in the home environment (see Patient Teaching box on disinfection and sterilization).

There are two accepted methods of disinfection and sterilization (see Box 12-13). One is a physical process that uses heat or radiation; the second process uses chemicals. Both methods destroy microorganisms. The method used depends on the following factors: (1) the type of microorganisms present (spore-forming bacteria are resistant to destruction); (2) how many microorganisms are present (it takes longer to kill a large number); and (3) the type of article in need of cleansing (some materials are so sensitive that heat or certain chemicals destroy them). Other determinants of the sterilization method used are (1) the intended use for the article (surgery, for instance, requires that all organisms be destroyed, whereas medical asepsis requires removal of pathogens only), and (2) the methods of sterilization available.

Chemicals used effectively in sterilization and disinfection are iodine, alcohol, and chlorine bleach com-

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**Skill 12-10 Preparing for Disinfection and Sterilization**

**Nursing Action (Rationale)**

1. Prepare equipment and supplies. (Ensures organization of procedure.)
   - Disinfectant to use for cleansing. (Aids in appropriate care of equipment and reusable supplies.)
   - Method of sterilization. (Ensures that appropriate method is used.)
   - Gloves. (Protects you from contamination.)
   - Running water. (Aids in cleansing and rinsing of articles.)
   - Scrub brush. (Aids in cleansing grooves.)
   - Cloth wrapper. (Provides the means for wrapping articles requiring sterilization.)
2. Don gloves. (Protects you from contamination.)
3. Rinse article under cool running water. (Emulsifies or softens soil for removal.)
4. Wash article with detergent. (Emulsifies or softens dirt for easy removal.)
5. Use scrub brush to remove material in grooves. (Friction loosens material in corners and grooves.)
6. Dry article thoroughly. (Prevents the growth of microorganisms.)
7. Prepare article for sterilization by wrapping it in cloth wrapper. (Promotes appropriate sterilization of the article.)
8. Clean work area and put in order. (Prevents the spread of microorganisms.)
9. Perform patient teaching (see Patient Teaching box on disinfection and sterilization at home.)
Chlorine bleach is useful for household disinfecting and in disinfection of water, but it is important never to mix it with ammonia because of the resulting emission of toxic fumes. Chlorine bleach has a tendency to corrode some metals. Iodine is a good bactericidal agent (i.e., it kills bacteria but not spores). Iodine leaves behind stains and is not used as widely as it once was.

Meticulous physical cleaning is required to precede both high-level disinfection and sterilization. Visible pieces of contamination (tissue, blood) will prevent disinfection or sterilization from occurring. Expect high-level disinfection and sterilization to destroy vegetative (those substances of or pertaining to the plant kingdom) microorganisms, most fungal spores, tubercle bacilli, and some viruses (see Skill 12-10).

### Patient Teaching

**Disinfection and Sterilization at Home**

- Teach the patient about using an oven or a pressure cooker for sterilization.
- Teach the patient that microwaves are widely used.
- Teach the patient that exposure to sunlight is helpful.
- Teach the patient about destroying microorganisms by boiling contaminated articles.

**Infection Prevention and Control for Older Adults**

- The older adult experiences an alteration in integrity of the oral mucosa. Promote careful oral hygiene and stress regular dental care.
- The older adult experiences a decrease in the production of digestive acid. Teach the older patient to carefully wash hands before food preparation, to adequately cook foods, and to refrigerate unused portions promptly.
- The dermal and epidermal skin layers of the older adult become thinner, and elasticity is decreased. Turn the bedridden patient frequently, and carefully observe the skin for impairment.
- The older adult experiences urethral stricture, neurogenic bladder, and prostatic enlargement. In the older patient with an indwelling Foley catheter, assess for adequate drainage and maintain cleanliness of the urethra and the perineal area.
- Older adults experience a decrease in ribcage movement during inspiration. In caring for older adults postoperatively, elevate the head of the bed (if indicated) and encourage the patient to cough and breathe deeply and to get out of bed as soon as possible to prevent postoperative complications such as hypostatic pneumonia.

### Infection Prevention and Control

Patients are now commonly discharged from acute care to home care sooner than in the past. Thus they often require care from home health personnel. Infections that develop within 30 days after discharge, such as a wound infection at an operative site, are at times an outcome of hospitalization, and the hospital infection preventionist needs to receive a report of them. As more patients elect to die at home, care for the dying will make similar care and reporting measures necessary in more cases. The epidemiologic (pertaining to the study of the occurrence, distribution, and causes of disease in humankind) basis of infections developing in homes is sometimes of a
community-wide nature. Thus the patient may develop influenza, an enteric infection, or a streptococcal pharyngitis as it passes through the community.

As home care and hospice programs continue to expand, questions about infection prevention and control in these settings are emerging. The reliability of hospital infection rates depends directly on accurate attribution of the source of infection. Such accuracy tends to be problematic when rapid hospital discharges leave unclear the source of an infection. Hospitalized patients need to receive education and instruction at discharge about reporting to appropriate personnel the occurrence of any signs and symptoms of infection such as pain, erythema (redness), edema (swelling), drainage or exudate, and fever (see Health Promotion box).

NURSING PROCESS
The role of the licensed practical nurse/licensed vocational nurse (LPN/LVN) in the nursing process as stated is that the LPN/LVN will:

- Participate in planning care for patients based on patient needs

Health Promotion
Prevention of Infection in the Home Setting
The basic principles of hygiene are important to prevent the spread of infection in the home setting: bathing; not sharing personal articles such as combs, toothbrushes, razors, and washcloths; and covering one’s mouth when coughing and sneezing. Patient education on the risks of spreading hospital-acquired infections to family or friends is very important, especially when family members will be assisting at home in changing dressings, intravenous infusions, or incontinent patients’ catheters in the refrigerator. Wash hands before food preparation. Using a dishwasher or washing dishes in hot soapy water decreases the risk of contamination.

- Tube feedings. Prepare enough formula for only 8 hours (commercially prepared) or 4 hours (home prepared). Contaminated enteral feeding will sometimes cause salmonella or staphylococcal infections. Cleanse or replace feeding bag and tubing per manufacturer’s recommendations.
- Linens. Wash linens that are contaminated with blood or body fluids separately in hot, soapy water using 1 cup of bleach per load, and dry them in a dryer on the hot cycle.
- Waste containers. Keep waste containers available in the patient contact area for the disposal of dressings, diapers, tissues, and other disposable items. Place a sturdy bag inside the waste container to prevent spilling and leakage. Flush body fluids such as urine, vomitus, feces, and blood down the toilet.
- Body fluid spills. Clean up any accidental body fluid spill as soon as possible, while wearing gloves. To disinfect, spray a solution of 1 cup of bleach diluted with 10 cups of water over the spill, and clean up with paper towels. Then place the paper towels in the plastic-lined waste container.
• Review patient’s plan of care and recommend revisions as needed
• Review and follow defined prioritization for patient care
• Use clinical pathways/care maps/care plans to guide and review patient care

Assessment
By evaluating signs and symptoms revealed during assessment, you are able to determine whether a patient’s clinical condition indicates a risk for infection. Early recognition of infection will help you in making a correct nursing diagnosis and thus establishing an appropriate treatment plan. Also consider how well the patient is adjusting to the disease and what, if any, are the needs for resources to assist in the management of health problems. Including the patient’s family is also important: How does the infection affect them?

Assess laboratory data as soon as available. Laboratory values such as increased white blood cell count or a positive blood culture often indicate infection. When assessing laboratory data, consider the age of the patient. For example, in the older adult, smaller amounts of bacteria such as *Salmonella* have potential to cause gastrointestinal infections because of the decrease in bactericidal gastric acids and deterioration of the mucosal layer of the stomach.

Sometimes positive laboratory results indicate the patient’s risk for infection and the need to use barrier precautions or isolation. In this case, consult the infection preventionist or refer to the facility’s infection prevention and control policy manual.

Nursing Diagnosis
The selection of a nursing diagnosis is based on data collected during assessment. Possible nursing diagnoses for patients susceptible to or affected by an infection include the following:

• Impaired tissue integrity
• Risk for infection (see Nursing Care Plan)
• Social isolation

Expected Outcomes and Planning
The plan of care focuses on achieving specific goals and outcomes related to the nursing diagnoses chosen. Interventions are determined with the aid of the patient, the family, the physician, and other members of the health care team. These goals and outcomes possibly include the following:

Goal 1: Transmission of infectious organism is prevented.  
Outcome: Patient does not experience onset of health care–associated infection.

Goal 2: Progress of infection is controlled or decreased.  
Outcome: Inflammation or signs and symptoms over an involved site decrease in 5 days.

Implementation
Your role is to prevent the onset and spread of infection and promote measures for treatment. By recognizing and assessing a patient’s risk factors and implementing appropriate measures, you have the capacity to reduce the risk of infections. Appropriate measures to include are good hand hygiene techniques and the proper use of sterile supplies and barrier protection.

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**Nursing Care Plan**  
**Infection**

This care plan has been adopted for the patient who is at risk for infection. Mr. R. is a 68-year-old male in the nursing unit for 8-hour postop care after bowel resection. He has intravenous fluids infusing and a urethral catheter in place.

**Nursing Diagnosis**  
Risk for infection, related to presence of abdominal incision, intravenous devices, age, presence of indwelling urinary catheter

<table>
<thead>
<tr>
<th>Patient Goals and Expected Outcomes</th>
<th>Nursing Intervention</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient remains free of infection as evidenced by normal vital signs and absence of purulent drainage from abdominal incision, tubes, and catheter</td>
<td>Assess for presence or existence of risk factors such as abdominal incision, indwelling catheter, and venous or arterial devices</td>
<td>Patient demonstrates understanding of necessary precautions to prevent infection</td>
</tr>
<tr>
<td></td>
<td>Monitor white blood count (WBC)</td>
<td>Patient remains free of infection</td>
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<tr>
<td></td>
<td>Monitor the following for signs and symptoms of infection: Erythema (redness) Edema (swelling) Increased pain Purulent exudates (drainage) at incision, exit sites of IV, Foley catheter Elevated temperature Color of respiratory secretions Appearance of urine</td>
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Continued
the patient does develop an infection, you will want to continue these interventions to ensure that health care personnel and other patients are not exposed to the pathogenic organism.

### Evaluation

The success of the nurse who practices infection prevention and control techniques is measured according to the extent to which the goals are achieved for reducing or preventing infection. Evaluation is by nature ongoing because a patient’s condition can change at any time. You are then in a position to decide to continue nursing interventions, revise them as necessary, or determine that the problem has been resolved. This will be accomplished by referring to the goals and outcomes identified when planning care.

**Goal 1:** Transmission of infectious organisms is controlled.

### Patient Goals and Expected Outcomes

<table>
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<th>Patient Goals and Expected Outcomes</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Patient remains free of infection as evidenced by normal vital signs and absence of purulent drainage from abdominal incision, tubes, and catheter—cont’d</td>
<td>Assess nutritional status, Perform asepsis for wound care, catheter care, and IV access management, Maintain hand hygiene before patient contact and between procedures with patient, Encourage diet and fluid intake (contact dietitian as necessary), Encourage coughing and deep breathing; consider use of incentive spirometer, Teach patient and family how to perform hand hygiene correctly</td>
<td>Patient remains free of infection as evidenced by normal vital signs and absence of purulent drainage from abdominal incision, tubes, and catheter—cont’d</td>
</tr>
</tbody>
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### Critical Thinking Questions

1. The patient has a peripheral IV infusing and complains of discomfort at the site of insertion. What should you do?
2. The patient has a urinary catheter connected to continuous drainage. He complains of burning at the site of insertion and you note dark, concentrated urine in the tubing. What should you do next?
3. You note on the sheet of lab results for the patient that his white blood count is 10,000/mm³. Why is this a concern, and what is recommended as a precautionary measure?

### Coordinated Care

#### Supervision

**INFECTION PREVENTION AND CONTROL**

Hand hygiene or antisepsis involves a set of basic procedures that all caregivers are obliged to perform correctly. If you observe other caregivers or family caregivers cleanse their hands incorrectly, reinforce the importance of the correct technique and procedural steps.

*Observe the consistency and thoroughness of staff in washing or disinfecting hands.*

Applying disposable gloves is a basic procedure that should be performed correctly by assistive personnel (AP). If you observe AP failing to use gloves when necessary, reinforce the importance of the procedure.

It is acceptable to delegate to AP basic care procedures (e.g., bathing and feeding) that are performed under airborne infection isolation (see Skill 12-5). You are responsible for assessing whether it is more effective to provide direct care or delegate care activities, depending on the patient’s clinical status. Procedures such as medication administration and care of IV lines require the critical thinking and knowledge application unique to the nurse.

*Clarify for AP special precautions in use of a fitted respirator mask.*

Nurses generally perform procedures requiring sterile technique and do not delegate them to AP. In some settings, AP (surgical technicians) are specifically trained to perform sterile technique under the supervision of a nurse. Check agency policy. The AP can help you in the circulating nurse role by opening sterile supplies (see Box 12-11), setting up a sterile field (see Skill 12-7), and running errands under your direction.
The mucous membranes of the respiratory, gastrointestinal, and genitourinary tracts provide primary defense against pathogenic microorganisms, as does intact skin.

An infection has potential to develop as long as the six elements composing the infectious chain are uninterrupted.

A microorganism’s virulence depends on its ability to resist attack by the body’s normal defenses.

Age, poor nutrition, stress, inherited conditions, chronic disease, and treatments or conditions that compromise the immune system increase susceptibility to infection.

The signs of local inflammation and infection are similar, but it is possible for the inflammatory response to occur in the absence of an infectious process.

Surgical asepsis requires more stringent techniques than medical asepsis and is directed toward eliminating all microorganisms and their spores.

Contamination of a sterile object or field occurs when it comes into contact with a wet surface that contains microorganisms or when it is exposed to airborne microorganisms.

The CDC recommends that health care workers consider all patients as infectious and to use standard precautions to reduce the risk of exposure to blood and body fluids.

Following aseptic principles is the key to a nurse’s success in preventing patients from acquiring infection.

Do not take an article (e.g., sphygmomanometer or blood pressure cuff) into an isolation room if the article is to be used by another patient.

Lack of proper hand hygiene is the main cause of the spread of infections.

An infection preventionist monitors the incidence of infections within an institution and provides educational and consultative services to maintain aseptic practices to staff, patients, and their caregivers.

Isolation transmission-based precautions are used to prevent personnel and patients from acquiring infections and prevent transmission of microorganisms to other persons.

Wearing gloves, gowns, and masks in combination with eye protection devices such as goggles or glasses with solid side shields is mandatory when contact with blood or potentially infectious material is possible or whenever splashing or spraying of blood or potentially infectious material is possible.

Evaluative measures: Assess patient’s temperature; observe wound sites for erythema, edema, tenderness, or exudate.

Goal 2: Progression of infection is controlled or decreased.

Evaluative measures: Inspect size of inflamed area over consecutive intervals; gently palpate involved site to note reduction in tenderness.

See the Coordinated Care box for infection prevention and control procedures.

Key Points

- The restricted environment subjects a patient in transmission-based isolation to psychological and emotional deprivation.
- Standard precautions are used to prevent the spread of organisms present in blood, all other body fluids, nonintact skin, and mucous membranes.
- Standard precautions are used with all patients since it is often unknown which patients have an infection. This includes the use of barrier protection when appropriate.
- If the skin is broken or if you perform an invasive procedure into a body cavity normally free of microorganisms, surgical aseptic practices are followed.
- The major sites for health care–associated infections include the urinary and respiratory tracts, the bloodstream, and surgical or traumatic wounds.
- You need to be a role model and keep up to date with your own immunizations, as well as teaching your patients to do so.
- Proper cleansing requires mechanical removal of all foreign materials from an object or area.
- Cultural influences play a major role in patient education and follow-up care.

Additional Learning Resources

Go to your Companion CD for an audio glossary, animations, video clips, and more!

Be sure to visit the Evolve site at http://evolve.elsevier.com/Christensen/foundations/ for additional online resources.

Review Questions for the NCLEX® Examination

1. A 24-year-old was admitted to a medical unit with the diagnosis of hepatitis A and placed in contact isolation. The purpose of this is to:
   1. prevent transmission of infectious microorganisms.
   2. control the environment of the patient.
   3. protect the patient from infectious microorganisms.
   4. protect only the family.

2. The nurse is working in a clinical medical area with a census of 15. Each patient has a different illness. The most important skill the nurse can use to protect each patient from health care–associated infections is:
   1. wearing a gown.
   2. placing each patient in isolation.
   3. hand hygiene.
   4. wearing gloves.
3. The nurse caring for the patient in isolation wears latex gloves. Which is an important consideration?
   1. First assess the patient for potential latex allergy.
   2. Vinyl gloves actually provide higher barrier protection than latex.
   3. The cost of latex gloves is significantly higher than that of synthetic gloves.
   4. Latex gloves are so reliable as barriers that hand hygiene is not required.

4. The nurse notes that the patient understands proper technique for hand hygiene when the patient states:
   1. “The water I wash my hands with should be as hot as I can tolerate to kill all of the germs on my skin.”
   2. “If there isn’t time to completely wash my hands, it will be all right to rinse them quickly in warm water.”
   3. “After washing my hands with soap for at least 15 seconds, I will rinse them thoroughly under running water.”
   4. “I will put soap into a basin of warm water, lather my hands for 15 seconds, and then rinse them in the basin.”

5. Identification of the chain of infection allows health care providers to:
   1. test patients for resistance to communicable diseases.
   2. request more money for building isolation hospitals.
   3. work with the physician to identify the most appropriate antibiotic.
   4. determine points at which the infection can be stopped or prevented.

6. A patient in isolation is experiencing signs of social deprivation. Which intervention by the nurse is appropriate?
   1. Allow visitors to remove masks while in the patient’s room.
   2. Leave the door of the negative-pressure room open slightly.
   3. Remind the patient that the isolation is for his or her own benefit.
   4. Set specific times when the nurse will return to the patient’s room.

7. A 45-year-old man was admitted to the hospital with cellulitis of the right foot. Three days later, he developed bacterial pneumonia. This type of bacterial infection is classified as:
   1. acute primary.
   2. health care–associated.
   3. interstitial.
   4. mycoplasmic.

8. Which statement is true of sterile technique?
   1. Sterilization is the practice that helps confine or reduce the number of microorganisms.
   2. When an item has been disinfected, it is to be considered sterile.
   3. Recently opened wrappers are considered sterile to within 1 inch of their edges.
   4. Surgical asepsis and clean technique are the same.

9. Because sterile technique is used in many procedures of patient care, it is important for the nurse to remember to hold sterile objects:
   1. close to shoulder level.
   2. just below waist level.
   3. anywhere as long as they are handled with sterile gloves.
   4. above waist level.

10. Although surgical asepsis is practiced in the operating room and in other specialty areas, the nurse will at times also use surgical aseptic technique at the patient’s bedside. For which procedure will the nurse employ surgical asepsis?
    1. Inserting an IV
    2. Performing perineal care
    3. Performing oral care
    4. Obtaining a sputum specimen

11. The nurse is performing a surgical hand scrub. During a surgical hand scrub, the hands are held:
    1. above the elbows.
    2. with the fingers pointing downward.
    3. whichever way is convenient.
    4. just below the waist.

12. To practice strict surgical asepsis, the nurse will:
    1. adhere to principles of sterile technique.
    2. perform routine environmental cleaning.
    3. disinfect surfaces that come into contact with body fluids.
    4. maintain proper hand hygiene before and after patient care.

13. When donning sterile gloves, the nurse will:
    1. touch only the inside surface of the first glove while pulling it onto the hand.
    2. place the fingers of the dominant hand into the outside cuff of the first glove.
    3. let the cuff of the glove roll up over the hand as it is being pulled onto the hand.
    4. begin the procedure by pulling the first glove upward and over the nondominant hand.

14. To remove gloves at the end of a procedure, the nurse will:
    1. pull each finger from each of the gloves first, then roll the glove back over the hand.
    2. remove the glove from the nondominant hand by reaching inside the glove and pulling it off.
    3. remove one glove, then use the bare fingers to push the remaining glove off from inside the cuff.
    4. hold both gloved hands under running water and roll the gloves down to keep microorganisms contained.

15. Which is a principle of surgical asepsis?
    1. Any sterilized item is considered unsterile once it is allowed to fall below knee height.
    2. Sterile fields and sterilized items are no longer sterile if they contact a clean surface.
    3. A person not wearing sterile garments can come no closer to a sterile field than 3 feet.
    4. The front and back of a sterile gown being worn are considered sterile from shoulders to knees.
16. A patient isolated for pulmonary tuberculosis seems to be angry, but the nurse knows this is a normal response to isolation. The best intervention would be to:
1. provide a dark, quiet room to calm the patient.
2. explain isolation procedures and provide meaningful stimulation.
3. reduce the level of precautions to keep the patient from becoming angry.
4. limit family and other caregiver visits to reduce the risk of spreading the infection.

17. After administering care to a patient, the nurse needs to remove a tray of soiled instruments from the room and “bag” the materials. Some of the items are metal, whereas others are made of plastic. The nurse knows that:
1. it is acceptable to place everything into one bag as long as it is labeled properly.
2. it is necessary to bag the metal items and send them for autoclaving, and acceptable to dispose of the plastic items.
3. it is necessary to separate the items: plastic goes into one bag for gas sterilization, and metal into another to be autoclaved.
4. the type of bag doesn’t matter as long as it is labeled “isolation.”

18. The nurse is assisting the physician with an irrigation of a draining abdominal wound by preparing the sterile tray. It is necessary to maintain sterility of the tray at all times. During the process the nurse will:
1. use sterile forceps while reaching across it to move the contents around.
2. wear clean gloves to handle the contents of the tray.
3. allow the open tray to stand unattended for 20 minutes, then cover it with a towel.
4. put on sterile gloves to handle the contents of the tray.

19. The nurse is assigned to represent the unit on the infection prevention and control committee. The committee is discussing the CDC’s hand hygiene recommendations for implementation in the hospital. Which statement demonstrates an understanding of the CDC’s recommendation?
1. Health care providers will wear gloves at all times when providing patient care.
2. Disinfecting hands following glove removal is not necessary.
3. Alcohol-based hand cleaner is effective on hands that are not visibly soiled with blood and body fluids.
4. It is necessary to remove waterless alcohol-based hand cleaner with paper towels to remove pathogens from hands.

20. The nurse just completed a sterile dressing change on a patient’s postoperative incision, and is preparing to measure the patient’s vital signs. In regard to the gloves worn during application of the sterile dressing, the nurse should:
1. leave the gloves on, since they are sterile, and measure the vital signs.
2. remove the gloves, and perform hand hygiene before measuring the vital signs.
3. remove the gloves, and leave the room to perform hand hygiene.
4. remove the gloves, measure the vital signs, and then perform hand hygiene.

21. The nurse will wear a gown during care of an infected wound for any patient in this type of isolation:
1. airborne precautions.
2. droplet precautions.
3. contact precautions.
4. TB precautions.

22. The nurse is preparing to change the tracheostomy ties on a patient. Which precaution would necessitate wearing a mask?
1. Airborne precautions
2. Droplet precautions
3. Contact precautions
4. Standard precautions

23. The nurse is preparing to open the outer sterile wrap of a Foley (indwelling catheter) tray. Which flap of the wrap (in which direction) should be opened first?
1. The flap that opens away from the nurse
2. The flap that opens to the left
3. The flap that opens to the right
4. The flap that opens toward the nurse

24. The patient asks the nurse how his skin will be sterilized before his surgery. The nurse’s best response is:
1. “We will use alcohol to sterilize your skin.”
2. “It is not possible to sterilize skin, but we will use an antimicrobial solution to eliminate most microbes.”
3. “There are a series of steps used in sterilizing your skin in order to prevent you from getting an infection.”
4. “We will use Betadine solution to sterilize your skin.”