

## Chapter 3

# Infection Control, Safety, First Aid, and Personal Wellness

### NAACLS Entry Level Competencies

- 2.00** Demonstrate knowledge of infection control and safety.
- 2.1** Identify policies and procedures for maintaining laboratory safety.
- 2.2** Demonstrate accepted practices for infection control, isolation techniques, aseptic techniques, and methods for disease prevention.
- 2.3** Comply with federal, state, and locally mandated regulations regarding safety practices.
- 9.9** List the causes of stress in the work environment and discuss the coping skills used to deal with stress in the work environment.

### Key Terms



*Do Matching Exercise 3-1 in the WORKBOOK to gain familiarity with these terms.*

asepsis	HCV	nosocomial	SDS
BBP	HICPAC	infection	standard
Biohazard	HIV	OSHA	precautions
CDC	immune	parenteral	susceptible host
chain of infection	infectious/	pathogenic	transmission-
engineering	causative	pathogens	based
controls	agent	percutaneous	precautions
EPA	isolation	permucosal	vector
fire tetrahedron	procedures	pictogram	transmission
fomites	microbe	PPE	vehicle
HAI	neutropenic	reservoir	transmission
HBV	NHSN	reverse	work practice
HCS	NIOSH	isolation	controls

### Objectives

**Upon successful completion of this chapter, the reader should be able to:**

- 1** Demonstrate knowledge of terminology and practices related to Infection Control and identify agencies associated with infection control precautions, procedures, and programs.
- 2** Identify key elements of the Blood-Borne Pathogen Standard and the Needlestick Safety and Prevention Act, and identify associated organizations.

- 3 Identify hazards, warning symbols, and safety rules related to the laboratory, patient areas, and biological, electrical, fire, radiation, and chemical safety, and discuss actions to take if incidents occur.

## Overview

This chapter covers infection control, safety, first aid, and personal wellness. A thorough knowledge in these areas is necessary for phlebotomists to protect themselves, patients, coworkers, and others from infection or injury, react quickly and skillfully in emergency situations, and stay healthy both physically and emotionally, all without compromising the quality of patient care. This chapter explains the process of infection, identifies the components of the chain of infection, lists required safety equipment, and describes infection control procedures. Also covered are biological, electrical, fire, radiation, and chemical hazards and the safety precautions, rules, and procedures necessary to eliminate or minimize them. First aid issues covered include control of external hemorrhage and how to recognize and treat shock victims. Wellness issues addressed include the prevention of back injury, benefits of exercise, and dealing with stress.

## Infection Control

Although important advances have been made in understanding and treating infection, the threat of infection looms as large as ever. New enemies in the battle against infection emerge, and enemies that had once been conquered may become resistant to treatment, as in the case of *Mycobacterium tuberculosis* and methicillin-resistant *Staphylococcus aureus*. Blood collection personnel typically encounter numerous patients every day, many of whom may be harboring infectious microorganisms. Measures to prevent the spread of infection must be taken in the course of all patient encounters. This portion of the chapter explains the infection process and describes infection control measures needed to protect blood collection personnel, patients, staff, visitors, and those doing business within healthcare facilities. Infection control involves implementing procedures and policies that prevent infection; it starts with an understanding of the process of infection.

## Infection

**Infection** is a condition that results when a microorganism (**microbe** for short) is able to invade the body, multiply, and cause injury or disease. Microbes include bacteria, fungi, protozoa, and viruses. Most microbes are nonpathogenic, meaning that they do not cause disease

- 4 Recognize symptoms needing first aid and list the main points of the American Heart Association CPR and ECC guidelines.
- 5 Describe the role of personal wellness as it relates to nutrition, rest, exercise, stress management, and back protection.

under normal conditions. Microbes that are **pathogenic** (causing or productive of disease) are called **pathogens**. We normally have many nonpathogenic microbes on our skin and in other areas such as the gastrointestinal (GI) tract. These microbes can become pathogens if they enter and multiply in areas of the body where they do not exist normally. Some microbes are pathogenic regardless of where they are found. Infections caused by pathogens can be local (restricted to a small area of the body) or systemic (sis-tem'ik), in which case the entire body is affected.

## COMMUNICABLE INFECTIONS

Some pathogenic microbes cause infections that are **communicable** (able to spread from person to person); the diseases that result are called communicable diseases. An agency of the U.S. Department of Health and Human Services called the **Centers for Disease Control and Prevention (CDC)** is charged with the investigation and control of various diseases, especially those that are communicable and have epidemic potential. The CDC also develops guidelines and recommends safety precautions to protect healthcare workers and others from infection.



**Key Point** The **National Institute for Occupational Safety and Health (NIOSH)**, which is part of the CDC, is responsible for conducting research and making recommendations for the prevention of work-related illness and injury.

## NOSOCOMIAL AND HEALTHCARE-ASSOCIATED INFECTIONS

The term **nosocomial infection** is applied to patient infections acquired in hospitals. **Healthcare-associated infection (HAI)** is a newer term that applies to infections acquired during healthcare delivery in all healthcare settings, including home care. HAIs can result from contact with various sources, including infected personnel, other patients, visitors, and contaminated food, drugs, or equipment. An HAI prevalence survey of U.S. acute care hospitals conducted by the CDC in 2011, found that on any given day, about 1 in 25 patients has at least one HAI, and up to 1 in 9 end up dying from it. According to the Institute of Medicine 5% to 15% of patients in all types of U.S. healthcare facilities are exposed to and

## Box 3-1

## CDC List of Diseases and Organisms Found in Healthcare Settings

- *Acinetobacter*
- *Burkholderia cepacia*
- *Clostridium difficile*
- *Clostridium sordellii*
- Enterobacteriaceae (carbapenem-resistance)
- Gram-negative bacteria
- Hepatitis
- Human Immunodeficiency Virus (HIV/AIDS)
- Influenza
- Klebsiella
- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- *Mycobacterium abscessus*
- Norovirus
- *Pseudomonas aeruginosa*
- *Staphylococcus aureus*
- Tuberculosis (TB)
- Vancomycin-intermediate *Staphylococcus aureus* (VISA)
- Vancomycin-resistant *Staphylococcus aureus* (VRSA)
- Vancomycin-resistant enterococci (VRE)

Reprinted from U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of Healthcare Quality Promotion (DHQP). *Diseases and Organisms in Healthcare Settings*. Accessed April 9, 2014, from <http://www.cdc.gov/hai/organisms/organisms.html>

contract an infection after admission. This results in an estimated 2 million infections and 90,000 associated deaths each year. (See Box 3-1 for a CDC list of diseases and organisms found in healthcare settings).



**Key Point** According to the HAI prevalence survey, for the first time, the most common healthcare-associated pathogen was *Clostridium difficile* (*C. difficile* or *C. diff*), just barely surpassing *Staphylococcus aureus*, which had previously held the top spot.

The most widely used HAI tracking system is provided by the CDC **National Healthcare Safety Network (NHSN)**. Data provided by NHSN helps U.S. healthcare facilities eliminate HAIs by identifying problem areas and measuring progress of prevention efforts. HAI prevention efforts are also aided by the **Healthcare Infection Control Practices Advisory Committee (HICPAC)**, which provides the CDC with advice and guidance regarding the practice of infection control and prevention in healthcare settings, the updating of CDC guidelines, and the development of new CDC infection control guidelines.



**Key Point** The most common type of HAI reported to NHSN is urinary tract infection (UTI), accounting for over 30% of all HAIs.

## ANTIBIOTIC-RESISTANT INFECTIONS

A core activity of the CDC is monitoring the magnitude, extent, and trends of antibiotic resistance, which is the ability of microbes to develop resistance to specific antibiotics, and a growing problem that is of great concern to public health. Antibiotic resistance leads to much suffering and increases a patient's risk of dying from once easily treatable infections.

### Well-Established Antibiotic-Resistant Bacteria

Well-known enemies in the antibiotic resistance fight include the three of the most common HAI pathogens, *C. difficile* (*C. diff*), methicillin-resistant *Staphylococcus aureus* (staph) *aureus* (MRSA), and *Enterococcus*. Some progress has been made in reducing infections caused by these bacteria, but they still pose a major threat and continue to be responsible for many HAIs.

*C. diff*, a type of intestinal bacteria that multiplies when patients are treated with antibiotics, is responsible for mild to very severe GI infections, and is the most commonly identified cause of diarrhea in healthcare settings. MRSA is responsible for many types of HAIs from skin, wound, and surgical site infections, to pneumonia and bloodstream infections that can be fatal.



**Key Point** MRSA has also become a growing community concern in the United States, and according to the CDC, the most commonly identified antibiotic-resistant pathogen in many other areas of the world too.

*Enterococcus* bacteria are normally present in the digestive tract and female genital tract where they do not pose a threat to healthy individuals. They do however pose a serious threat to those more susceptible to

infection such as the elderly, intensive care unit (ICU) patients, and those with chronic diseases such as diabetes or kidney failure. *Enterococcus* infections include bloodstream infections, wound and surgical site infections, and UTIs. About 30% of *Enterococcus* HAIs are vancomycin resistant.

### Multidrug-Resistant Gram-Negative Bacteria

The newest challenge in antibiotic resistance in the healthcare setting comes from multidrug-resistant gram-negative bacteria. Some of these bacteria are resistant to almost all available treatments. Of primary concern are bacteria that are resistant to a class of drugs called Carbapenems that have traditionally been considered the “last resort” for treating bacterial infections such as *Escherichia coli* (*E. coli*), which causes the majority of urinary tract infections, and *Klebsiella pneumoniae*, which causes many types of HAIs. Other examples of drug-resistant gram-negative bacteria are *Acinetobacter baumannii*, responsible for many wound infections, and *Pseudomonas aeruginosa*, often the cause of bloodstream infections and pneumonia.

## The Chain of Infection

Infection transmission requires the presence of a number of components, which make up what is referred to as the **chain of infection** (Fig. 3-1). The chain must be

complete for an infection to occur. If the process of infection is stopped at any component or link in the chain, an infection is prevented. However, when a pathogen successfully enters a susceptible host, the chain is completed, the host becomes a new source of infectious microorganisms, and the process of infection continues.



**Key Point** A phlebotomist, whose duties involve contact with many patients, must be fully aware of the infection process and take precautions to prevent the spread of infection.

### CHAIN OF INFECTION COMPONENTS

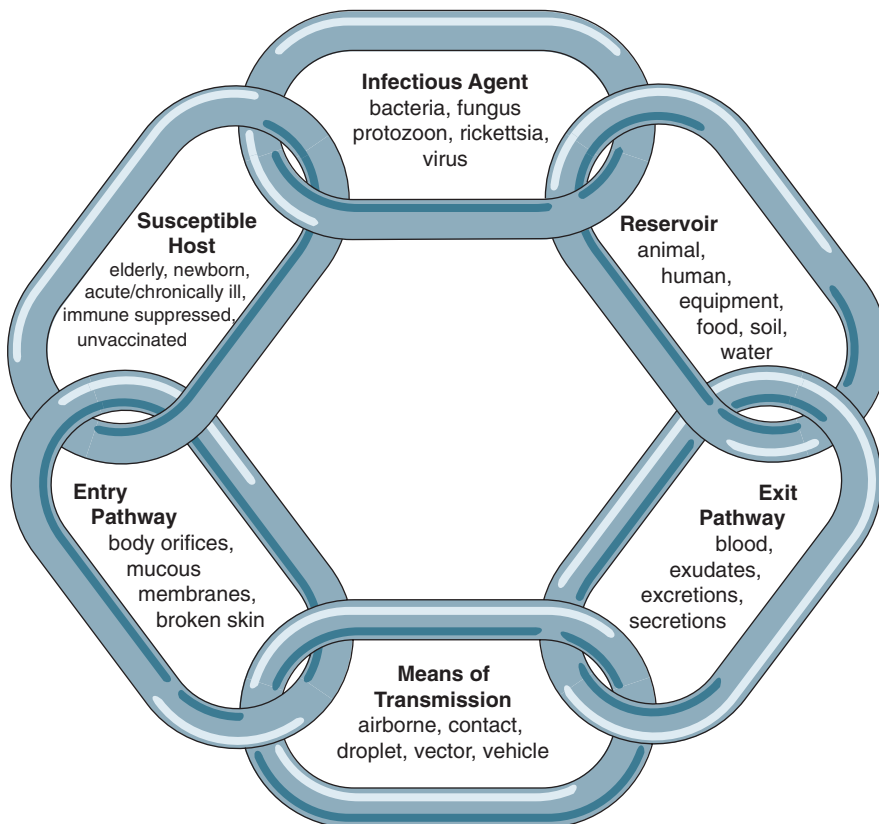
There are six key components or “links” in the chain of infection that must be present for an infection to occur. They are an **infectious agent**, a **reservoir**, an **exit pathway**, a **means of transmission**, an **entry pathway**, and a **susceptible host**.

#### Infectious Agent

The infectious agent, also called the **causative agent**, is the pathogenic microbe responsible for causing an infection.

#### Reservoir

The source of an infectious agent is called a reservoir. It is a place where the microbe can survive, grow, or



**Figure 3-1** The chain of infection.

multiply. Reservoirs include humans, animals, food, water, soil, and contaminated articles and equipment. An individual or animal infected with a pathogenic microbe is called a reservoir host. Human reservoir hosts can be patients, personnel, or visitors and include those with an active disease, those incubating a disease, and chronic carriers of a disease. Another reservoir for potentially infectious microbes is a person's own normal flora (microorganisms that normally live on the skin and other areas of the human body).

Contaminated articles and equipment can be a major source of infectious agents. The ability of these inanimate objects to transmit infectious agents depends upon the amount of contamination, the **viability** or ability of the microbe to survive on the object, the **virulence** or degree to which the microbe is capable of causing disease, and the amount of time that has passed since the item was contaminated. For example, **hepatitis B virus (HBV)**, the virus that causes hepatitis B, is much more virulent than **human immunodeficiency virus (HIV)**, the virus that causes AIDS, because a smaller amount of HBV infective material is capable of causing disease. HBV is also more viable because it is capable of surviving longer on surfaces than HIV. However, if enough time elapses from the time of contamination until contact by a susceptible host, it is no longer alive and therefore unable to transmit disease.

### Exit Pathway

An exit pathway is a way an infectious agent is able to leave a reservoir host. Infectious agents can exit a reservoir host in secretions from the eyes, nose, or mouth; exudates from wounds; tissue specimens; blood from venipuncture and skin puncture sites; and excretions of feces and urine.

### Means of Transmission

The means of transmission is the method an infectious agent uses to travel from a reservoir to a susceptible individual. Means of infection transmission include **airborne, contact, droplet, vector, and vehicle**. The same microbe can be transmitted by more than one route.

#### Airborne Transmission

**Airborne transmission** involves dispersal of infectious agents that can remain infective for long periods of time in particles that are typically less than 5  $\mu\text{m}$  in diameter and can be inhaled, such as droplet nuclei (residue of evaporated droplets). The particles, generated by sneezing, coughing, talking, and activities that produce aerosols, can remain suspended in the air or in dust particles and become widely dispersed and eventually inhaled by susceptible individuals who have not been anywhere near the infectious individual. Consequently, any patient with an airborne infection requires an **airborne infection isolation room (AIIR)**



**Figure 3-2** N95 respirator. (Courtesy of 3M Occupational Health and Environmental Safety Division. St. Paul, MN.)

that has special air handling and ventilation. Anyone who enters an AIIR should wear a NIOSH certified N95 (N category, 95% efficiency) or higher-level respirator (Fig. 3-2).



**Key Point** *Mycobacterium tuberculosis*, rubella virus, and varicella virus are examples of infectious agents spread by airborne transmission.



**Test your knowledge of Key Points with WORKBOOK Knowledge Drill 3-1.**

#### Contact Transmission

**Contact transmission** is the most common means of transmitting infection. There are two types of contact transmission: direct and indirect. **Direct contact transmission** is the physical transfer of an infectious agent to a susceptible host through close or intimate contact such as touching or kissing. **Indirect contact transmission** can occur when a susceptible host touches contaminated objects such as patient bed linens, clothing, dressings, and eating utensils. It includes contact with phlebotomy equipment such as gloves, needles, specimen tubes, testing equipment, and trays. It also includes less obvious contaminated objects such as countertops, computer keyboards, phones, pens, pencils, doorknobs, and faucet handles. The transfer of infectious agents from contaminated hands to a susceptible host is also considered indirect contact transmission.



Inanimate objects that can harbor material containing infectious agents are called **fomites** (fo'mi-tez).

### Droplet Transmission

**Droplet transmission** is the transfer of an infectious agent to the mucous membranes of the mouth, nose, or conjunctiva of the eyes of a susceptible individual via infectious droplets (particles 5  $\mu\text{m}$  in diameter or larger) generated by coughing, sneezing, or talking or through procedures such as suctioning or throat swab collection.



**Key Point** Droplet transmission differs from airborne transmission in that droplets normally travel less than 10 feet and do not remain suspended in the air.

### Vector Transmission

**Vector transmission** is the transfer of an infectious agent carried by an insect, arthropod, or animal. Examples of vector transmission include the transmission of West Nile virus by mosquitoes and bubonic plague (*Yersinia pestis*) by rodent fleas.

### Vehicle Transmission

**Vehicle transmission** is the transmission of an infectious agent through contaminated food, water, or drugs. Examples of vehicle transmission are *Salmonella* infection from handling contaminated chicken and *Shigella* infection from drinking contaminated water.



**Key Point** The transmission of hepatitis viruses and HIV through blood transfusion is also considered vehicle transmission.

### Entry Pathway

The entry pathway is the way an infectious agent is able to enter a susceptible host. Entry pathways include body orifices (openings); mucous membranes of the eyes, nose, or mouth; and breaks in the skin. Patients' entry pathways can be exposed during invasive procedures such as catheterization, venipuncture, fingersticks, and heel puncture. Entry pathways of healthcare personnel can be exposed during spills and splashes of infectious specimens or created by needlesticks and injuries from other sharp objects.

### Susceptible Host

A **susceptible host** is someone with a decreased ability to resist infection. Factors that affect susceptibility include age, health, and immune status. For example, newborns

are more susceptible to infection because their immune systems are still forming, and the elderly are more susceptible because their immune systems weaken with age. Disease, antibiotic treatment, immunosuppressive drugs, and procedures such as surgery, anesthesia, and insertion of catheters can all leave a patient more susceptible to infection. A healthy person who has received a vaccination against an infection with a particular virus or recovered from one has developed antibodies against that virus and is considered to be **immune**, or unlikely to develop the disease.



**Key Point** Individuals who are exposed to the hepatitis B virus (HBV) are less likely to contract the disease if they have previously completed an HBV vaccination series.



A microorganism that primarily infects individuals with weakened immune systems is called an opportunist. One classic opportunist that is becoming more and more of a threat is a type of bacterium called *Acinetobacter baumannii*. It is found most commonly in hospitals, infecting the chronically ill, the elderly, patients with HIV, and transplant patients.

## BREAKING THE CHAIN OF INFECTION

Breaking the chain of infection involves stopping infections at the source, preventing contact with substances from exit pathways, eliminating means of transmission, blocking exposure to entry pathways, and reducing or eliminating the susceptibility of potential hosts. Examples of ways to break the chain and prevent infections are shown in Box 3-2.

## Infection Control Programs

The Joint Commission requires every healthcare institution to have an infection control program responsible for protecting patients, employees, visitors, and anyone doing business within healthcare institutions from infection. A typical infection control program implements procedures aimed at breaking the chain of infection, monitors and collects data on all infections occurring within the institution, and institutes special precautions in the event of outbreaks of specific infections.

## EMPLOYEE SCREENING AND IMMUNIZATION

An important way in which infection control programs prevent infection is through employee screening and

## Box 3-2

### Examples of Ways to Break the Chain of Infection

#### Ways Healthcare Workers Break the Chain

- Effective hand hygiene procedures
- Good nutrition, adequate rest, and reduction of stress
- Immunization against common pathogens
- Proper decontamination of surfaces and instruments
- Proper disposal of sharps and infectious waste
- Use of gloves and other personal protective equipment (PPE) when indicated
- Use of needle safety devices during blood collection

#### Ways Healthcare Institutions Break the Chain

- Infection control programs
- Insect and rodent control
- Isolation procedures

immunization programs. Screening for infectious diseases typically takes place prior to or upon employment and on a regular basis throughout employment. Employee screening tests typically include a tuberculosis (TB) test; employees with positive TB test results receive chest x-ray evaluations to determine their status. Screening tests may also include tests for diarrheal and skin diseases. Employees with certain conditions or infections may be subject to work restrictions. (Conditions requiring work restrictions are listed in Appendix D.)



**Key Point** Tests for TB include the tuberculin skin test (TST), also called a PPD test after the purified protein derivative used, and a relatively new TB test called the QuantiFERON®-TB Gold (QFT-G) test that requires collection of a blood sample.

Immunizations typically required include current HBV; measles, mumps, rubella (MMR); diphtheria; and tetanus vaccinations or proof of immunity. Most employers provide vaccinations free of charge.



**Key Point** OSHA regulations require employers to offer HBV vaccination free of charge to employees whose duties involve risk of exposure.

## EVALUATION AND TREATMENT

An infection control program also provides for the evaluation and treatment of employees who are exposed to infections on the job. This includes Occupational Safety and Health Administration (OSHA)-mandated confidential medical evaluation, treatment, counseling, and follow-up as a result of exposure to blood-borne pathogens.

## SURVEILLANCE

Another major function of an infection control program is surveillance or monitoring. This involves closely watching patients and employees at risk of acquiring infections as well as collecting, evaluating, and distributing data on infections contracted by patients and employees. Infection control measures are updated and new policies instituted based on this information.



The CDC developed **The National Surveillance System For Healthcare Workers (NaSH)** to collaborate with healthcare facilities in the collection of information important in preventing occupational exposure and infection among healthcare workers.

## Infection Control Practices

Since infectious microbes are invisible to the naked eye it is easy to forget that the healthcare environment can be teeming with them. Studies have shown that patient items and anything in the surrounding area such as chairs, privacy curtains, floors, night stands, and tray tables can be contaminated with potential pathogens. Many of the contaminating organisms can stay viable for weeks; some even for months. Consequently all healthcare workers (HCWs) must be mindful of contamination sources and take measures to prevent the spread of infection.



**Key Point** Good infection control practices prevent the spread of infection in the healthcare setting and to the community as well.

## Box 3-3

### Situations That Require Hand Hygiene Procedures

- Before and after each patient contact
- Between unrelated procedures on a patient such as wound care and drawing blood
- Before putting on gloves and after taking them off
- Before leaving the laboratory
- Before going to lunch or on break
- Before and after going to the restroom
- Whenever hands become visibly or knowingly contaminated

## HAND HYGIENE

Hand hygiene is one of the most important means of preventing the spread of infection provided that it is achieved properly and when required. Hand hygiene measures include the frequent use of alcohol-based antiseptic hand cleaners or hand washing, depending upon the degree of contamination. It is important that all healthcare personnel learn proper hand hygiene procedures and recognize situations when they should be performed. Box 3-3 lists situations that require hand hygiene procedures.

Hand hygiene effectiveness can be reduced by the type and length of fingernails. Studies have shown that artificial nails harbor more pathogenic microbes than natural nails. Consequently many healthcare facilities ban the wearing of artificial nails for all who provide patient care.



**Key Point** The World Health Organization (WHO) consensus recommendations in the 2009 Guidelines on Hand Hygiene in Health Care are that HCWs do not wear artificial fingernails or extenders when having direct contact with patients and natural nails should be kept short (0.5 cm long or approximately 1/4 inch long).

### Use of Alcohol-Based Antiseptic Hand Cleaners

CDC/HICPAC guidelines recommend the use of alcohol-based antiseptic hand cleaners (gels, foams, and rinses) in place of hand washing as long as the hands are not visibly soiled. These products have been shown to have

superior **microbicidal** (destructive to microbes) activity. Sufficient cleaner must be used to cover all surfaces of the hands, including between the fingers, and the alcohol must be allowed to evaporate to achieve proper antiseptics. Studies have shown that alcohol-based cleaners can be used multiple times in a row, however, if hands become visibly soiled or feel as if something is on them they should be washed with soap and water. In addition, if hands are heavily contaminated with organic material and hand washing facilities are not available, it is recommended that hands be cleaned with detergent containing wipes, followed by the use of an alcohol-based antiseptic hand cleaner.



**CAUTION** The spores of some microbes such as *C. Diff* (*Clostridium difficile*) are not killed by alcohol-based hand cleaners. Patients known to be infected with such microbes will normally be in contact isolation with a sign posted to remind those who enter the room that washing hands with soap and water is required before leaving the room. See Figure 3-3.



Test your knowledge of proper hand washing procedure with **WORKBOOK Skills Drill 3-3**.

## Hand Washing

There are different methods of hand washing, depending on the degree of contamination and the level of



**Figure 3-3** Stop sign reminder to wash hands with soap and water.

antimicrobial activity required. A routine hand washing procedure uses plain soap and water to mechanically remove soil and transient bacteria. According to the CDC, hand antisepsis requires the use of an antimicrobial soap to remove, kill, or inhibit transient microorganisms. A 2-minute surgical hand scrub uses an antimicrobial soap or equivalent to remove or destroy transient microorganisms and reduce levels of normal flora prior to surgical procedures. Proper routine hand washing procedure is described in Procedure 3-1.

**thePoint** *View the Hand Washing/Hand Antisepsis video at <http://thepoint.lww.com/McCall6e>.*

## USE OF PERSONAL PROTECTIVE EQUIPMENT

Protective clothing and other items worn by an individual to protect mucous membranes, airways, skin, and clothing from contact with infectious substances is called **personal protective equipment (PPE)**. PPE provides a barrier against infection. Used properly, it protects those wearing it. Disposed of properly, it prevents spread of infection to others. The type of PPE required depends upon the type of precautions required. (See Isolation Precautions) PPE includes the following.

**thePoint** *View the Donning and Removal of Protective Equipment video at <http://thepoint.lww.com/McCall6e>.*

### Procedure 3-1: Hand Washing Technique

**PURPOSE:** Decontaminate hands to prevent the spread of infection

**EQUIPMENT:** Liquid soap, disposable towels, trash can

#### Step

1. Stand back so that you do not touch the sink.
2. Turn on the faucet and wet hands under warm running water.



3. Apply soap and work up a lather.
4. Scrub all surfaces, including between the fingers and around the knuckles.



#### Explanation/Rationale

The sink may be contaminated.

Water should not be too hot or too cold and hands should be wet before applying soap to minimize drying, chapping, or cracking of hands from frequent hand washing.

A good lather is needed to reach all surfaces.

Scrubbing is necessary to dislodge microorganisms from surfaces, especially between fingers and around knuckles.

## Procedure 3-1: Hand Washing Technique (Continued)

### Step

5. Rub your hands together vigorously.
6. Rinse your hands in a downward motion from wrists to fingertips.



7. Dry hands with a clean paper towel.



8. Use a clean paper towel to turn off the faucet unless it is foot or motion activated.

### Explanation/Rationale

Friction helps loosen dead skin, dirt, debris, and microorganisms. (Steps 4 and 5 should take at least 20 seconds, about the time it takes to sing the ABCs or the happy birthday song two times from beginning to end).

Rinsing with the hands downward allows contaminants to be flushed from the hands and fingers into the sink rather than flowing back up the arm or wrist.

Hands must be dried thoroughly and gently to prevent chapping or cracking. Reusable towels can be a source of contamination.

Clean hands should not touch contaminated faucet handles.

Images from Kronenberger J, Woodson, D. *Lippincott Williams & Wilkins Clinical Medical Assisting*. 4th ed. Baltimore, MD: Lippincott Williams & Wilkins; 2012.

### Gloves

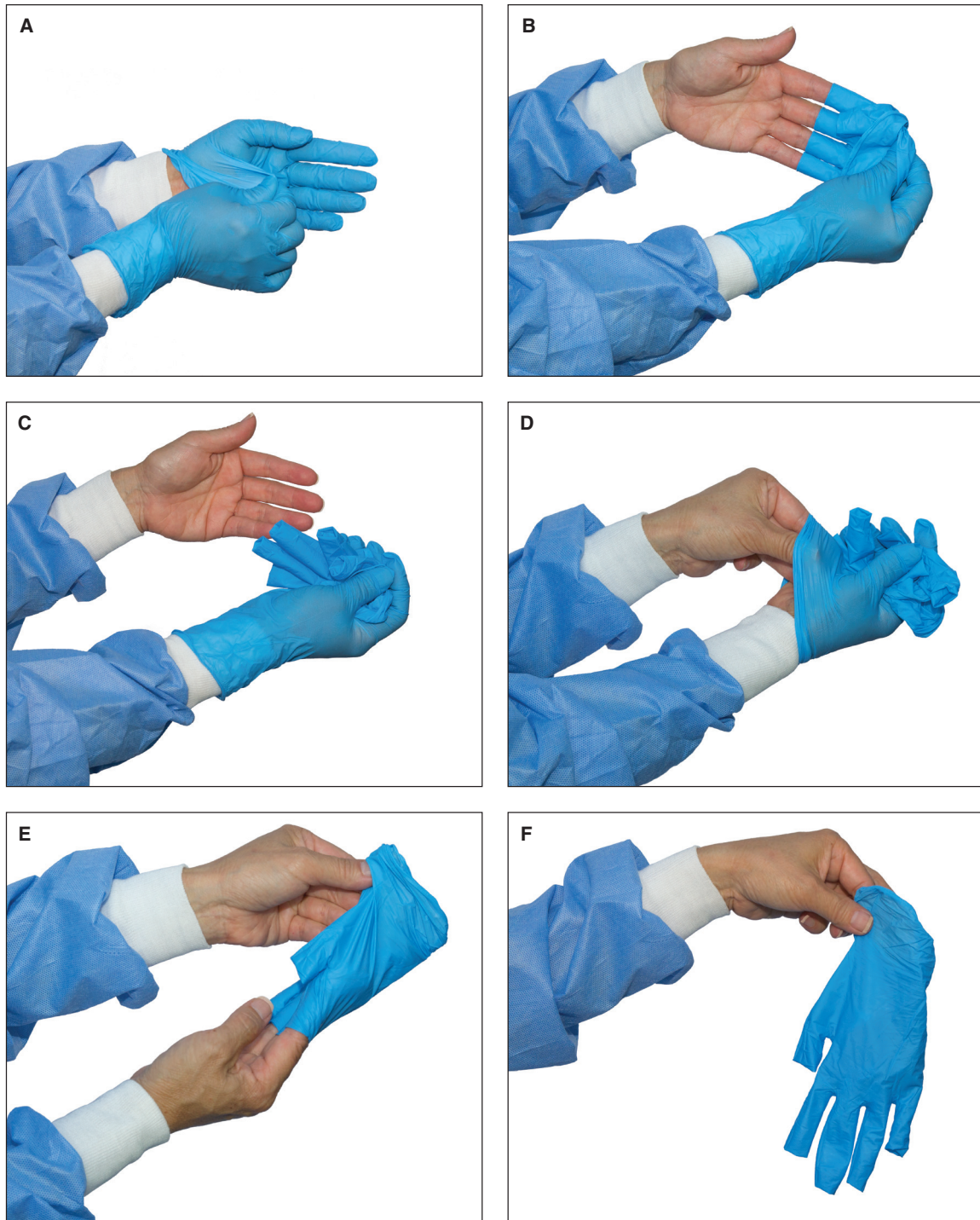
Clean, nonsterile gloves are worn when collecting or handling blood and other body fluids, handling contaminated items, and touching nonintact skin or mucous membranes. Gloves should be pulled over the cuffs of gowns or lab coats to provide adequate protection. Three main reasons for wearing gloves are as follows:

- To prevent contamination of the hands when handling blood or body fluids or when touching mucous membranes or nonintact skin

- To reduce the chance of transmitting organisms on the hands of personnel to patients during invasive or other procedures that involve touching a patient's skin or mucous membranes
- To minimize the possibility of transmitting infectious microorganisms from one patient to another



**Key Point** Wearing gloves during phlebotomy procedures is mandated by the OSHA blood-borne pathogens standard.



**Figure 3-4** Glove removal. **A:** The outside of one glove is grasped below the wrist with the opposite gloved hand. **B:** The glove is pulled inside out, over the hand. **C:** The glove is pulled off the hand and held in the gloved hand. **D:** The fingers of the nongloved hand are slipped under the wrist of the remaining glove without touching the exterior surfaces. **E:** The glove is then pulled inside out over the hand so that the first glove ends up inside the second glove, with no exterior glove surfaces exposed. **F:** Contaminated gloves ready to be dropped into the proper waste receptacle.

### Proper Glove Removal

After use, gloves must be removed in a manner that does not contaminate the hands, and then promptly discarded. To remove gloves properly (Fig. 3-4), grasp the

outside of one glove below the wrist and pull it inside out and off the hand, ending up with it in the palm of the still-gloved hand. Slip fingers of the ungloved hand under the second glove at the wrist and pull it off the

hand, ending with one glove inside the other with the contaminated surfaces inside.



**Key Point** Glove use does not replace the need for hand hygiene. Hands should be sanitized immediately after glove removal and before going to another patient, back to the laboratory, or performing other duties.

## Gowns

Clean, nonsterile, fluid-resistant gowns are worn by healthcare personnel to protect the skin and prevent contamination of clothing during patient-care activities in which splashes or sprays of blood or body fluids are possible or when entering isolation rooms (see Isolation Procedures). Sterile gowns are worn to protect certain patients (such as newborns and patients with compromised immune systems) from contaminants on the healthcare worker's clothing. Most gowns are made of disposable cloth or paper, are generous in size to adequately cover clothing, have long sleeves with knit cuffs, and fasten in the back.

### Putting On and Removing Gowns

When putting on a gown, only inside surfaces of the gown should be touched. A properly worn gown has the sleeves pulled all the way to the wrist, and the gown overlapped and wrapped around the back, completely closed, and securely fastened at the neck and waist. To remove a gown, unfasten the ties, pull the gown away from the neck and shoulders by touching the inside only, and slide the arms out of the sleeves, turning the gown inside out. Hold the gown away from the body, fold or roll it into a bundle, and discard in a waste container.

## Lab Coats and Scrubs

Lab coats, like gowns, are worn to protect skin and prevent soiling of healthcare workers' clothing during patient-care activities in which splashes or sprays of blood or body fluids are possible. They are required attire for most phlebotomy situations. Lab coats used for specimen collection and handling are generally made of fluid-resistant cotton or synthetic material, have long sleeves with knit cuffs, and come in both reusable and disposable styles.



**Key Point** Lab coats worn as PPE must not be worn on break, in the cafeteria or other nonpatient areas, or outside the hospital.

Scrubs are considered street clothes and not PPE unless they are put on at work and removed before leaving work. Scrubs worn home can carry microbes with

them, including *C. difficile* spores, which can survive for months on surfaces.



**Key Point** Scrubs or other pants that touch the floor can easily pick up infectious material. According to CLSI laboratory safety guidelines, pants worn by laboratory personnel should be 1 to 1½ inches off of the floor to prevent contamination.

## Masks, Face Shields, and Goggles

A mask is worn to protect against droplets generated by coughing or sneezing. To put on a mask, place it over your nose and mouth. Adjust the metal band (if applicable) to fit snugly over your nose. For masks with ties, fasten the top ties around the upper portion of your head; then tie the lower ones at the back of your neck. If the mask has elastic fasteners, slip them around your ears. A face shield or a mask and goggles are worn to protect the eyes, nose, and mouth from splashes or sprays of body fluids. If an activity requires goggles, it also requires a mask. Some masks have plastic eye shields attached.



**CAUTION** Masks should be for one use only. If hung around the neck for reuse they can become reservoirs for bacteria and viruses.

## Respirators

NIOSH-approved N95 respirators (Fig. 3-2) are required when entering rooms of patients with pulmonary TB and other diseases with airborne transmission. Respirators must fit snugly with no air leaks.

**thePoint** See the *Donning and Removal of Protective Equipment* video at <http://thepoint.lww.com/McCall6e>.

## SEQUENCE FOR DONNING AND REMOVING PPE

When donning (putting on) a complete set of PPE such as gown, mask, and gloves, the gown is put on first (Fig. 3-5A). The mask or respirator, if indicated, is put on next, making certain it covers the nose and mouth (Fig. 3-5B). If goggles or face shield are required, they are put on after the mask or respirator. Gloves are put on last and pulled over the cuffs of the gown (Fig. 3-5C).

Except for a respirator, protective clothing worn in isolation rooms is removed at the door before leaving the patient room or anteroom. Protective items must be removed in an aseptic (sterile or pathogen free) manner to prevent contamination of the wearer, and promptly



**Figure 3-5** Protective clothing. **A:** Phlebotomist slips arms into a protective gown. **B:** A mask is applied by slipping the elastic band over the ears. **C:** Gloves are put on last and pulled over the gown cuffs.

discarded. Gloves are removed first, being careful not to touch contaminated surfaces with ungloved hands. Goggles or face shields can be removed next, touching only the headband or ear pieces. The gown is then removed by pulling it from the shoulders toward the hands so that it turns inside out. It must be held away from the body and rolled into a bundle before discarding. The mask is removed last touching only the strings. A respirator is removed touching only the elastic band, and only after leaving the patient's room and closing the door. Hands must then be immediately decontaminated.



At one time protective clothing worn in isolation required double bagging after removal. With the advent of standard precautions (See Guideline for Isolation Precautions later in this chapter) double bagging is no longer recommended unless a bag containing contaminated items is visibly contaminated on the outside or contamination has soaked through the bag.

## ASEPSIS AND ASEPTIC TECHNIQUE

**Asepsis** is a condition of being free of contamination or germs (microbes) that could cause disease. Something that is free of disease causing microbes (i.e., pathogens) is said to be aseptic. **Aseptic technique** is a healthcare practice used to reduce the chance of microbial contamination with the goal of protecting patients from infection and preventing the spread of infection.



**Key Point** Any patient is potentially susceptible to infection, although those with certain conditions such as severe burns or immune system disorders are more vulnerable.

Aseptic techniques important to blood collection personnel include:

- following proper hand hygiene procedures
- keeping supplies within easy reach to prevent dropping them
- opening equipment packages in a way that avoids contamination
- prompt and safe disposal of contaminated equipment
- prompt cleanup up of infectious material
- wearing gloves and other PPE when indicated

## NURSERY AND NEONATAL ICU INFECTION CONTROL TECHNIQUE

Newborns are more susceptible to infections than healthy older children and adults because their immune systems are not yet fully developed. Consequently, anyone who enters the nursery or other neonatal unit should use special infection control techniques. No one is allowed to enter if they have symptoms of illness such as cough, chills, or fever. Typical nursery and neonatal ICU infection control technique includes the following:

- Wash hands thoroughly and put on clean gloves.
- Gather only those items necessary to perform the specimen collection.

- Leave the blood collection tray or cart outside the nursery.
- Remove gloves, decontaminate hands, and put on new gloves between patients.

## Isolation Procedures

One way in which an infection control program minimizes the spread of infection is through the establishment of **isolation procedures**. Isolation procedures separate patients with certain transmissible infections from contact with other patients and limit their contact with hospital personnel and visitors. Isolating a patient requires a doctor's order and is implemented either to prevent the spread of infection from a patient who has or is suspected of having a contagious disease or to protect a patient whose immune system is compromised. Patients are most commonly isolated in a private room. A card or sign indicating the type of isolation along with a description of required precautions is typically posted on the patient's door. A cart containing supplies needed to enter the room or care for the patient is typically placed in the hall outside the door.



**CAUTION** Different types of isolation require the use of different types of PPE. Follow the directions on the precaution sign on the patient's door or check with the patient's nurse if instructed to do so, before entering an isolation room.

## PROTECTIVE/REVERSE ISOLATION

**Protective** or **reverse isolation** is used for patients who are highly susceptible to infections. In this type of isolation, protective measures are taken to keep healthcare workers and others from transmitting infection to the patient rather than vice versa. Patients who may require protective isolation include those with suppressed or compromised immune function, such as burn patients, organ transplant patients, AIDS patients, and **neutropenic** (having a low neutrophil count) chemotherapy patients.



A neutrophil is a type of white blood cell.

## UNIVERSAL PRECAUTIONS

At one time isolation systems required a diagnosis or the suspicion of a transmissible disease to be instituted. Precautions were based on either the type of disease or its mode of transmission and often resulted in over isolation and increased costs. This changed when the CDC instituted an infection control strategy called **Universal Precautions (UP)** after reports of healthcare

workers being infected with HIV through needlesticks and other exposures to HIV-contaminated blood. Under UP, the blood and certain body fluids of *all* individuals were considered potentially infectious. This changed the focus of infection control from prevention of patient-to-patient infection transmission, to prevention of patient-to-personnel transmission, and was a required part of an overall infection control plan.

## BODY SUBSTANCE ISOLATION

Shortly after the introduction of UP, another system called **Body Substance Isolation (BSI)** gained acceptance. The intent of BSI was to isolate workers from pathogens. BSI was also followed for *every* patient, but went beyond UP by requiring that gloves be worn when in contact with *any* moist body substance.

## GUIDELINE FOR ISOLATION PRECAUTIONS

Widespread variation in the use of UP or BSI, confusion over which body fluids required precautions, lack of agreement on the importance of hand washing after glove use, and the need for additional precautions to prevent transmission of infectious agents in addition to blood-borne pathogens led to the Guideline for Isolation Precautions in Hospitals, developed and issued jointly by the CDC and HICPAC.

This guideline, which has been updated and expanded to include precautions for preventing transmission of infectious agents in all healthcare settings, contains two tiers of precautions. The first tier, **standard precautions**, specifies precautions to use in caring for all patients regardless of diagnosis or presumed infection status. The second tier, **transmission-based precautions**, specifies precautions to use for patients either suspected or known to be infected with certain pathogens transmitted by airborne, droplet, or contact routes. The guideline also lists specific clinical conditions that are highly suspicious for infection and specifies appropriate transmission-based precautions to use for each, in addition to standard precautions, until a diagnosis can be made.

## Standard Precautions

Standard precautions (Fig. 3-6) are to be used in the care of all patients and constitute the number one strategy for prevention of HAIs. This blanket approach is necessary because a large percentage of individuals with infectious diseases do not have symptoms, and may not even know they have a disease. Standard precautions combine the major features of UP and BSI to minimize the risk of infection transmission from both recognized and unrecognized sources. Standard precautions apply to blood, *all* body fluids (including all secretions and excretions

# STANDARD PRECAUTIONS

## FOR INFECTION CONTROL

**Assume that every person is potentially infected or colonized with an organism that could be transmitted in the healthcare setting.**

**Hand Hygiene**  
 Avoid unnecessary touching of surfaces in close proximity to the patient.

When hands are visibly dirty, contaminated with proteinaceous material, or visibly soiled with blood or body fluids, wash hands with soap and water.

If hands are not visibly soiled, or after removing visible material with soap and water, decontaminate hands with an alcohol-based hand rub. Alternatively, hands may be washed with an antimicrobial soap and water.

**Perform hand hygiene:**  
**Before** having direct contact with patients.  
**After** contact with blood, body fluids or excretions, mucous membranes, nonintact skin, or wound dressings.  
**After** contact with a patient's intact skin (e.g., when taking a pulse or blood pressure or lifting a patient).  
**If** hands will be moving from a contaminated body site to a clean body site during patient care.  
**After** contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient.  
**After** removing gloves.

**Personal protective equipment (PPE)**  
 Wear PPE when the nature of the anticipated patient interaction indicates that contact with blood or body fluids may occur.

Before leaving the patient's room or cubicle, remove and discard PPE.

**Gloves**  
 Wear gloves when contact with blood or other potentially infectious materials, mucous membranes, nonintact skin, or potentially contaminated intact skin (e.g., of a patient incontinent of stool or urine) could occur.

Remove gloves after contact with a patient and/or the surrounding environment using proper technique to prevent hand contamination. Do not wear the same pair of gloves for the care of more than one patient.

Change gloves during patient care if the hands will move from a contaminated body site (e.g., perineal area) to a clean body site (e.g., face).

**Gowns**  
 Wear a gown to protect skin and prevent soiling or contamination of clothing during procedures and patient-care activities when contact with blood, body fluids, secretions, or excretions is anticipated.

Wear a gown for direct patient contact if the patient has uncontained secretions or excretions.

Remove gown and perform hand hygiene before leaving patient's environment.

**Mouth, nose, eye protection**  
 Use PPE to protect the mucous membranes of the eyes, nose and mouth during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions and excretions.

During aerosol-generating procedures wear one of the following: a face shield that fully covers the front and sides of the face, a mask with attached shield, or a mask and goggles.

**Respiratory Hygiene/Cough Etiquette**  
 Educate healthcare personnel to contain respiratory secretions to prevent droplet and fomite transmission of respiratory pathogens, especially during seasonal outbreaks of viral respiratory tract infections.

Offer masks to coughing patients and other symptomatic persons (e.g., persons who accompany ill patients) upon entry into the facility.

**Patient-Care equipment and instruments/devices**  
 Wear PPE (e.g., gloves, gown), according to the level of anticipated contamination, when handling patient-care equipment and instruments/devices that are visibly soiled or may have been in contact with blood or body fluids.





**Care of the environment**  
 Include multi-use electronic equipment in policies and procedures for preventing contamination and for cleaning and disinfection, especially those items that are used by patients, those used during delivery of patient care, and mobile devices that are moved in and out of patient rooms frequently (e.g., daily).


**Textiles and laundry**  
 Handle used textiles and fabrics with minimum agitation to avoid contamination of air, surfaces and persons.

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**Figure 3-6** Standard precautions signs. (Courtesy Brevis Corp., Salt Lake City, UT.)

# RESPIRATORY HYGIENE/COUGH ETIQUETTE



## VISITORS

Please immediately inform healthcare personnel if you have a cold or other respiratory infection.

**Respiratory Hygiene/Cough Etiquette**  
**All individuals with signs and symptoms of a respiratory infection should:**

1. Cover the nose and mouth when coughing or sneezing.
2. Use tissues to contain respiratory secretions.  
 Dispose of used tissues in a waste receptacle.
3. Use proper hand hygiene after contact with mucus and contaminated objects.

**Proper hand hygiene consists of:**

- a. Hand washing with plain soap and water—or
- b. Alcohol-based hand rub—or
- c. Antiseptic handwash.

---

**Masking and Separation of Persons with Respiratory Symptoms**  
 Offer masks to persons who are coughing. Masks with ear loops or with ties may be used to contain respiratory secretions. Encourage coughing persons to sit at least three feet away from others.

---

**Droplet Precautions**  
 Advise healthcare personnel to observe Droplet Precautions (i.e., wearing a surgical or procedure mask for close contact), in addition to Standard Precautions, when examining a patient with symptoms of a respiratory infection, particularly if fever is present.

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**Figure 3-7** Respiratory hygiene/cough etiquette. (Courtesy Brevis Corp., Salt Lake City, UT.)

except sweat, whether or not they contain visible blood), nonintact skin, and mucous membranes. Standard precautions include hand hygiene procedures and depending on the type of exposure to body fluids anticipated, the use of PPE such as gloves, gowns, and masks.



**Key Point** An update to the isolation precautions guideline added respiratory hygiene/cough etiquette as a standard precaution. (See Fig. 3-7) This precaution applies to all who enter a healthcare setting and includes covering the mouth and nose with tissue when coughing, prompt disposal of used tissues, hand hygiene after contact with respiratory secretions, and 3 feet of separation from persons with respiratory infections.

### Transmission-Based Precautions

Transmission-based precautions are to be used for patients known or suspected to be infected or colonized

with highly transmissible or epidemiologically (related to the study of epidemics) significant pathogens that require special precautions in addition to standard precautions. Table 3-1 lists clinical conditions that warrant transmission-based precautions pending diagnosis. Common diseases and conditions that require transmission-based precautions are listed in Table 3-2. Precautions may be combined for diseases that have more than one means of transmission. There are three types of transmission-based precautions:

- **Airborne precautions** (Fig. 3-8) or the equivalent, which must be used in addition to standard precautions for patients known or suspected to be infected with microorganisms transmitted by airborne droplet nuclei (particles smaller than 5  $\mu\text{m}$ )
- **Droplet precautions** (Fig. 3-9) or the equivalent, which must be used in addition to standard precautions for patients known or suspected to be infected with microorganisms transmitted by droplets (particles larger than 5  $\mu\text{m}$ ), generated when a patient

**Table 3-1: Clinical Conditions Warranting Transmission-Based Precautions Pending Confirmation of Diagnosis**

Condition	Potential Pathogen	Precaution
<b>Diarrhea</b>		
Acute diarrhea with a likely infectious cause in an incontinent or diapered patient	Enteric pathogen	Contact
Diarrhea in an adult with a history of broad-spectrum or long-term antibiotics	<i>Clostridium Difficile</i>	Contact
<b>Meningitis</b>	<i>Neisseria meningitidis</i>	Droplet
<b>Rash for Inflamed Skin Eruptions</b>		
Petechial/ecchymotic with fever	<i>Neisseria meningitidis</i>	Droplet
Vesicular	Varicella	Airborne and contact
Maculopapular	Rubeola (measles)	Airborne
<b>Respiratory Infections</b>		
Cough/fever/upper lobe pulmonary infiltrate in an HIV-negative patient and a patient at low risk for HIV infection	<i>Mycobacterium tuberculosis</i>	Airborne
Cough/fever/pulmonary infiltrate in any lung location in an HIV-infected patient and at high risk for HIV infection	<i>M. tuberculosis</i>	Airborne
Paroxysmal or severe persistent cough during periods of pertussis activity	<i>Bordetella pertussis</i>	Droplet
Respiratory infections, particularly bronchiolitis and croup, in infants and young children	Respiratory syncytial virus or parainfluenza virus	Contact
<b>Risk of Multidrug-Resistant Microorganisms</b>		
History of infection or colonization with multidrug-resistant organisms	Resistant bacteria	Contact
Skin, wound, or urinary tract infection in a patient with a recent hospital or nursing home stay in a facility where multidrug-resistant organisms are prevalent	Resistant bacteria	Contact
<b>Skin or Wound Infection</b>		
Abscess or draining wound that cannot be covered	<i>Staphylococcus aureus</i> Group A streptococcus	Contact

talks, coughs, or sneezes and during certain procedures such as suctioning

- **Contact precautions** (Fig. 3-10) or the equivalent, which must be used in addition to standard precautions when a patient is known or suspected to be infected or colonized with epidemiologically important microorganisms that can be transmitted by direct contact with the patient or indirect contact with surfaces or patient-care items

conditions must be ensured by employers as mandated by the Occupational Safety and Health Act and enforced by the **OSHA**. Even so, biological, electrical, radiation, and chemical hazards are encountered in a healthcare setting, often on a daily basis. It is important for the phlebotomist to be aware of the existence of hazards and know the safety precautions and rules necessary to eliminate or minimize them. General lab safety rules are listed in Box 3-4. Safety rules to follow when in patient rooms and other patient areas are listed in Box 3-5.

## Safety

Providing quality care in an environment that is safe for employees as well as patients is a concern that is foremost in the minds of healthcare providers. Safe working

## Biosafety

**Biosafety** is a term used to describe the safe handling of biological substances that pose a risk to health.

**Table 3-2:** Transmission-Based Precautions for Common Diseases and Conditions

Airborne Precautions	Droplet Precautions	Contact Precautions
Herpes zoster (shingles) <sup>a</sup>	Adenovirus infection <sup>b</sup>	Adenovirus infection <sup>b</sup>
Measles (rubeola)	Diphtheria (pharyngeal)	Cellulitis (uncontrolled drainage)
Pulmonary tuberculosis	<i>Haemophilus influenzae meningitis</i>	<i>Clostridium difficile</i>
Varicella (chickenpox)	Influenza	Conjunctivitis (acute viral)
	Meningococcal pneumonia	Decubitus ulcer (infected, major)
	Meningococcal sepsis	Diphtheria (cutaneous)
	Mumps (infectious parotitis)	Enteroviral infections <sup>a</sup>
	<i>Mycoplasma pneumoniae</i>	Herpes zoster (shingles) <sup>a</sup>
	<i>Neisseria meningitidis</i>	Impetigo
	Parvovirus B19	Parainfluenza virus
	Pertussis (whooping cough)	Pediculosis (lice)
	Pneumonic plague	Respiratory syncytial virus
	Rubella (German measles)	Rubella (congenital)
	Scarlet fever <sup>b</sup>	Scabies
		Varicella (chickenpox)

<sup>a</sup>Widely disseminated or in immunocompromised patients.

<sup>b</sup>Infants and children only.

## Box 3-4

### General Laboratory Safety Rules

- *Never* eat, drink, smoke, or chew gum in the laboratory. *Never* put pencils or pens in the mouth.
- *Never* place food or beverages in a refrigerator used for storing reagents or specimens.
- *Never* apply cosmetics, handle contact lenses, or rub eyes in the laboratory.
- *Never* wear long chains, large or dangling earrings, or loose bracelets.
- *Always* wear a fully buttoned lab coat when engaged in lab activities. *Never* wear a lab coat to lunch, on break, or when leaving the lab to go home. *Never* wear personal protective equipment outside the designated area for its use.
- *Always* tie back hair that is longer than shoulder length.
- *Always* keep finger nails short and well manicured. *Do not* wear nail polish or artificial nails. *Never* bite nails or cuticles.
- *Always* wear a face shield when performing specimen processing or any activity that might generate a splash or aerosol of bodily fluids.

Biological hazards can be encountered in a healthcare setting on a daily basis. Healthcare personnel must be able to recognize them in order to take the precautions necessary to eliminate or minimize exposure to them.



**Have some fun finding biohazard exposure route terms in the WORKBOOK Knowledge Drill 3-2.**

## BIOHAZARD

Anything harmful or potentially harmful to health is called a **biohazard** (short for biological hazard) and should be identified by a **biohazard symbol** (Fig. 3-11). Because most laboratory specimens have the potential to contain infectious agents, they are considered biohazards.

## BIOHAZARD EXPOSURE ROUTES

There are many routes by which healthcare workers can be exposed to biohazards. Ingestion is probably the most easily recognized, but routes other than the digestive tract, referred to as **parenteral** (par-en'ter-al) routes, can also result in biohazard exposure. The most common biohazard exposure routes are as follows.

### Airborne

Biohazards can become airborne and inhaled when splashes, aerosols, or fumes are generated. Aerosols

# AIRBORNE PRECAUTIONS

*(in addition to Standard Precautions)*



**STOP 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 **AIIR** (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 AIIR, the mask may be removed.



**Patient Transport**

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

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



**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.

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**Figure 3-8** Airborne precautions signs. (Courtesy Brevis Corp., Salt Lake City, UT.)


and splashes can be created when specimens are centrifuged, when tube stoppers are removed, and when specimen aliquots are being prepared. Dangerous fumes can be created if chemicals are improperly stored, mixed, or handled. Patients with airborne diseases can transmit infection to workers unless N95 respirators are worn when caring for them. Protection against airborne biohazard exposure includes following safe handling practices, wearing appropriate PPE, and working behind safety shields or splash guards.

### Ingestion

Biohazards can be ingested if healthcare workers neglect to sanitize hands before handling food, gum, candy, cigarettes, or drinks. Other activities that can lead to ingestion of biohazards include covering the mouth with hands instead of tissue when coughing or sneezing, biting nails, chewing on pens or pencils, and licking fingers when turning pages in books. Frequent hand sanitization, avoiding hand-to-mouth activities, and refraining from holding items in the mouth or chewing on them


# DROPLET PRECAUTIONS

*(in addition to Standard Precautions)*




**STOP VISITORS:** Report to nurse before entering.

---




**Personal Protective Equipment (PPE)**  
Don a mask upon entry into the patient room or cubicle.

---




**Hand Hygiene**  
according to Standard Precautions.

---



**Patient Placement**  
**Private room**, if possible. Cohort or place patient as far away from other patients as possible if private room is not available.

---




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

If transport or movement in any healthcare setting is necessary, instruct patient to **wear a mask** and follow Respiratory Hygiene/Cough Etiquette.

No mask is required for persons transporting patients on Droplet Precautions.

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**Figure 3-9** Droplet precautions signs. (Courtesy Brevis Corp., Salt Lake City, UT.)

provides the best defense against accidental ingestion of biohazardous substances.

### Nonintact Skin

Biohazards can enter the body through visible and invisible pre-existing breaks in the skin such as abrasions, burns, cuts, scratches, sores, dermatitis, and chapped skin. Defects in the skin should be covered with waterproof (nonpermeable) bandages to prevent contamination, even when gloves are worn.

### Percutaneous

**Percutaneous** (through the skin) exposure to biohazardous microorganisms in blood or body fluid occurs through intact (unbroken) skin as a result of accidental needlesticks and injuries from other sharps including broken glass and specimen tubes. Ways to reduce the chance of percutaneous exposure include using needle safety devices properly, wearing heavy-duty utility gloves when cleaning up broken glass, and never handling broken glass with the hands.

# CONTACT PRECAUTIONS

*(in addition to Standard Precautions)*

**STOP VISITORS: Report to nurse before entering.**

---



**Gloves**  
**Don** gloves upon entry into the room or cubicle.  
**Wear** gloves whenever touching the patient's intact skin or surfaces and articles in close proximity to the patient.  
**Remove** gloves before leaving patient room.

---



**Hand Hygiene**  
according to Standard Precautions

---



**Gowns**  
**Don** gown upon entry into the room or cubicle.  
**Remove** gown and observe hand hygiene before leaving the patient-care environment.

---



**Patient Transport**  
**Limit** transport of patients to medically necessary purposes.  
**Ensure** that infected or colonized areas of the patient's body are contained and covered.  
**Remove** and dispose of contaminated PPE and perform hand hygiene prior to transporting patients on Contact Precautions.  
**Don** clean PPE to handle the patient at the transport destination.

---



**Patient-Care Equipment**  
**Use** disposable noncritical patient-care equipment or implement patient-dedicated use of such equipment.

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**Figure 3-10** Contact precautions signs. (Courtesy Brevis Corp., Salt Lake City, UT.)



**Figure 3-11** The biohazard symbol.



See how well you know your airborne and blood-borne pathogens with **WORKBOOK Knowledge Drill 3-6**.

### Permucosal

**Permucosal** (through mucous membranes) exposure occurs when infectious microorganisms and other bio-hazards enter the body through the mucous membranes

## Box 3-5

### Safety Rules When in Patient Rooms and Other Patient Areas

- Avoid running. It is alarming to patients and visitors and may cause an accident.
- Be careful entering and exiting patient rooms; housekeeping equipment, dietary carts, x-ray machines, and other types of equipment may be just inside the door or outside in the hall.
- Do not touch electrical equipment in patient rooms while drawing blood. Electrical shock can pass through a phlebotomist and the needle and shock the patient.
- Follow standard precautions when handling specimens.
- Properly dispose of used and contaminated specimen collection supplies and return all other equipment to the collection tray before leaving the patient's room.
- Replace bedrails that were let down during patient procedures.
- Report infiltrated IVs or other IV problems to nursing personnel.
- Report unresponsive patients to nursing personnel.
- Report unusual odors to nursing personnel.
- Watch out for and report food, liquid, and other items spilled on the floor to appropriate personnel.

of the mouth and nose and the conjunctiva of the eyes in droplets generated by sneezing or coughing, splashes, and aerosols and by rubbing or touching the eyes, nose, or mouth with contaminated hands. The chance of per-mucosal exposure can be reduced by following procedures to prevent exposure to splashes and aerosols and avoiding rubbing or touching the eyes, nose, or mouth.

## BLOOD-BORNE PATHOGENS

The term **blood-borne pathogen (BBP)** is applied to any infectious microorganism present in blood and other body fluids and tissues. Such pathogens, which can be present in a patient's body fluids even if there are no symptoms of disease, are among the most significant biohazards faced by healthcare workers. Although HBV, **hepatitis C virus (HCV)**, and HIV tend to receive the most attention,

BBPs include other hepatitis viruses; cytomegalovirus (CMV); *Treponema pallidum*, the microbe that causes syphilis, the microbes that cause malaria and relapsing fever; the agent that causes Creutzfeldt–Jakob disease; and more recently, West Nile virus.

### HBV and HDV

Hepatitis B (once called serum hepatitis) is caused by HBV, a potentially life-threatening blood-borne pathogen that targets the liver. (*Hepatitis* means “inflammation of the liver.”) It has been the most frequently occurring laboratory-associated infection and the major occupational hazard in the healthcare industry, although the rate of infection has dropped substantially since the advent of HBV immunization programs in the 1980s. Anyone infected with HBV is at risk of also acquiring hepatitis D (delta) virus (HDV), which is able to multiply only in the presence of HBV.

### HBV Vaccination

The best defense against HBV infection is vaccination. The vaccination schedule most often used for adults is a series of three equal intramuscular injections of vaccine: an initial dose, a second dose 1 month after the first, and a third dose 6 months following the initial dose. The vaccine also protects against HDV since it can only be contracted concurrently with HBV infection. Success of immunization and proof of immunity can be determined 1 to 2 months after the last vaccination dose by a blood test that detects the presence of the hepatitis B surface antibody (anti-HBs) in the person's serum. OSHA requires employers to offer the vaccine free to employees within 10 working days of being assigned to duties with potential BBP exposure. Employees who refuse the vaccination must sign and date a declination (statement of refusal) form, which is kept in their personnel file.



The most commonly used hepatitis B vaccine does not contain live virus and poses no risk of transmitting HBV, which was a problem of earlier vaccines.

### HBV Exposure Hazards

HBV can be present in blood and other body fluids such as urine, semen, cerebrospinal fluid (CSF), and saliva. It can survive up to a week in dried blood on work surfaces, equipment, telephones, and other objects. In a healthcare setting, it is primarily transmitted through needles (a single needlestick can transmit HBV) and other sharps injuries and contact with contaminated equipment, objects, surfaces, aerosols, spills, and splashes. In nonmedical settings, it is transmitted primarily through sexual contact and sharing of dirty needles.

### Symptoms of HBV Infection

HBV symptoms resemble flu symptoms but generally last longer. They include fatigue; loss of appetite; mild fever; muscle, joint, and abdominal pain; nausea; and vomiting. Jaundice appears in about 25% of cases. About 50% of those infected show no symptoms. Some individuals become carriers who can pass the disease on to others. Carriers have an increased risk of developing cirrhosis of the liver and liver cancer. Active HBV infection is confirmed by detection of hepatitis B surface antigen (HBsAg) in an individual's serum.

### Hepatitis C Virus

Hepatitis C, caused by infection with HCV, has become the most widespread chronic blood-borne illness in the United States. The virus, discovered in 1988 by molecular cloning, was found to be the primary cause of non-A, non-B hepatitis. No vaccine is currently available, although research and development of a vaccine is underway.

### HCV Exposure Hazards

HCV is found primarily in blood and serum, less frequently in saliva, and seldom in urine and semen. It can enter the body in the same manner as HBV. However, infection primarily occurs after large or multiple exposures. As in the case of HBV, sexual contact and needle sharing are the primary means of transmission in non-medical settings.

### Symptoms of HCV Infection

HCV symptoms are similar to those of HBV infection, although only 25% to 30% of infections even cause symptoms. As with HBV, chronic and carrier states exist that can lead to cirrhosis of the liver and liver cancer. In fact, HCV infection is a leading indication for liver transplantation. HCV antibodies usually appear in a patient's serum from 4 to 10 weeks after infection occurs.

### Human Immunodeficiency Virus

HIV attacks the body's immune system, causing acquired immunodeficiency syndrome (AIDS) by leaving the body susceptible to opportunistic infections. Opportunistic infections are caused by organisms that would not ordinarily be pathogens to a normal healthy individual. HIV infection has a poor prognosis and is of great concern to healthcare workers.



**Key Point** Although the incidence of work-related HIV infection is relatively low, CDC studies have shown that phlebotomy procedures were involved in approximately 50% of the HIV exposures that have occurred so far in healthcare settings.

### HIV Exposure Hazards

HIV has been isolated from blood, semen, saliva, tears, urine, CSF, amniotic fluid, breast milk, cervical secretions, and tissue of infected persons. The risk to healthcare workers, however, is primarily through exposure to blood. HIV can enter the body through all the same routes as the hepatitis viruses.

### Symptoms of HIV Infection

The incubation phase of HIV infection is thought to range from a few weeks up to a year or more. Initial symptoms are mild to severe flu-like symptoms. During this phase, the virus enters the T lymphocytes (T lymphs or helper T cells), triggering them to produce multiple copies of the virus. The virus then enters a seemingly inactive incubation phase while hiding in the T lymphs. Certain conditions reactivate the virus, which slowly destroys the T lymphs. Once the T lymph count is reduced to 200 or fewer per milliliter of blood, the patient is officially diagnosed as having AIDS, the third and final phase of infection. In this phase, the immune system deteriorates significantly and opportunistic infections take hold. Two symptoms of AIDS are hairy leukoplakia, a white lesion on the tongue, and Kaposi sarcoma, a cancer of the capillaries that produces bluish-red nodules on the skin. End stages of AIDS are characterized by deterioration of the nervous system leading to neurological symptoms and dementia.

## OSHA BLOOD-BORNE PATHOGENS STANDARD

The OSHA **Blood-Borne Pathogens (BBP) Standard** was promulgated (put into force) when it was concluded that healthcare employees face a serious health risk from occupational exposure to blood and other body fluids and tissues. Enforcement of the standard, which is mandated by federal law, and for which OSHA is also responsible, is intended to reduce the chance of occupational exposure to BBPs. The standard requires implementation of **engineering controls** and **work practice controls** to prevent exposure incidents, availability and use of PPE, special training, medical surveillance, and the availability of vaccination against HBV for all at-risk employees. Although exposure to BBPs is still a serious issue, the incidence of occupationally acquired Hepatitis B infection has declined since the BBP Standard was put in to force.



**Key Point** Engineering controls are devices that isolate or remove a BBP hazard. Work practice controls are practices that change the way tasks are performed to reduce the likelihood of BBP exposure.

## NEEDLESTICK SAFETY AND PREVENTION ACT

The **Needlestick Safety and Prevention Act** imposed additional requirements on healthcare employers concerning sharps procedures in order to further reduce healthcare worker exposure to blood-borne pathogens. The act directed OSHA to revise the BBP standard in the following four key areas:

- Revision and updating of the exposure control plan
- Solicitation of employee input in selecting engineering and work practice controls
- Modification of definitions relating to engineering controls
- New record-keeping requirements, including the requirement to keep a sharps injury log.



According to safeneedle.org there are 384,000 needlestick injuries to U.S. hospital healthcare professionals every year.

## EXPOSURE CONTROL PLAN

To comply with the OSHA standard, employers must have a written exposure control plan. The plan must be reviewed and updated at least annually to document the evaluation and implementation of safer medical devices. Nonmanagerial employees with risk of exposure must be involved in the identification, review, and selection of engineering and work practice controls and their participation must be documented. Key elements of an exposure control plan are shown in Box 3-6.

## BBP EXPOSURE ROUTES

Occupational exposure to blood-borne pathogens can occur if any of the following happens while a healthcare worker is performing his or her duties.

- The skin is pierced by a contaminated needle or sharp object.
- Blood or other body fluid splashes into the eyes, nose, or mouth.
- Blood or other body fluid comes in contact with a cut, scratch, or abrasion.
- A human bite breaks the skin.

## EXPOSURE INCIDENT PROCEDURE

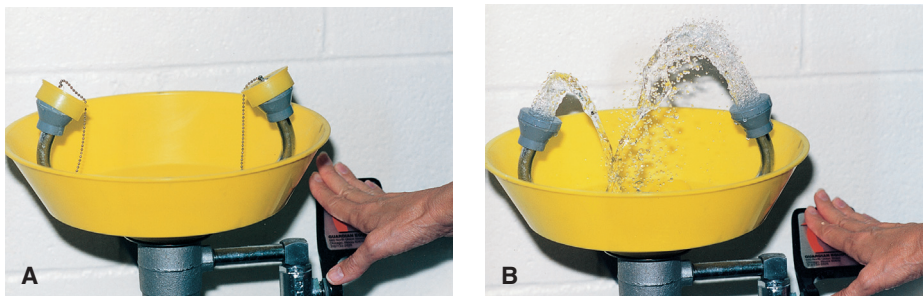
An exposure incident requires immediate attention for the most promising outcome in the event that the exposure involves a BBP. The immediate response by the employee in the event of an exposure incident includes the following:

- Needlestick or other sharps injury: Carefully remove shards of glass or other objects that may be embedded in the wound and wash the site with soap and water for a minimum of 30 seconds.



**Key Point** There is currently no scientific evidence that squeezing the wound or cleaning with an antiseptic reduces the transmission of BBPs. Cleaning with bleach or other caustic agents is not recommended.

- Mucous membrane exposure: Flush the site (i.e., eyes, nose, or mouth) with water or sterile saline for a minimum of 10 minutes. Use an eyewash station (Fig. 3-12) if available to adequately flush a splash to the eyes. Remove contact lenses as soon as possible and disinfect them before reuse or discard.
- Report the incident to the immediate supervisor.
- Report directly to a licensed healthcare provider for a medical evaluation, treatment if required, and counseling (see Box 3-7 for key elements of a postexposure medical evaluation).



**Figure 3-12** Eyewash basin. **A:** Press the lever at the right side of the basin. **B:** The stream of water forces the caps from the nozzles. Lower your face and eyes into the stream and continue to wash the area until the eyes are clear. (Reprinted with permission from Kronenberger J. *Lippincott Williams and Wilkins' Comprehensive Medical Assisting*. 4th ed. Baltimore, MD: Lippincott Williams & Wilkins; 2012.)

## Box 3-6

### Key Elements of an Exposure Control Plan

1. An exposure determination: A list of all job categories and tasks with potential BBP exposure
2. Methods of implementation and compliance including:
  - A *universal precautions statement* requiring all employees to observe UP or the equivalent.
  - *Engineering controls*, such as sharps disposal containers, self-sheathing needles, sharps with engineered sharps injury protections, and needleless systems that isolate or remove the BBP hazard.
  - *Work practice controls* that reduce likelihood of exposure by altering the way tasks are performed. Examples include policies that require hand washing after glove removal and prohibit eating, drinking, smoking, or applying cosmetics in laboratory work areas.
  - *PPE or barrier protection devices* such as gloves, gowns, lab coats, aprons, face shields, masks, and resuscitation mouthpieces that minimize the risk of BBP infection. Disposable PPE and laundry service for reusable PPE must be provided to the employee at no cost.
  - *Housekeeping schedule and methods* that require decontamination of work surfaces at least once a day and after any contact with blood or other potentially infectious material with 1:10 bleach solution or other EPA-approved disinfectant.
3. Hepatitis B vaccine and postexposure follow-up procedures.
4. Communication of hazards to employees in the form of:
  - *Warning labels and signs* attached to containers of potentially infectious material, including refrigerators and freezers where infectious material may be stored. Labels must be predominantly fluorescent orange or orange-red, containing a biohazard symbol and the word "biohazard." Red bags or containers may be substituted for labels.
  - *BBP training and information* provided to employees at no cost and during working hours when first assigned to tasks with risk of exposure. A copy of the BBP standard and an explanation of its contents readily available to employees. Provision for annual training within 1 year of initial training.
5. Record-keeping requirements include:
  - *Medical records*: A requirement for the employer to maintain confidential medical records on each employee with occupational exposure. Records must include the employee's name, social security number, and HBV vaccination status.
  - *Training records*: A requirement for the employer to maintain records of training sessions that include the content, the qualifications of persons conducting them, and the names and titles of persons attending.
  - *Sharps injury log*: A requirement for the employer to keep a log of injuries from contaminated sharps. The log entry should include where and how the incident occurred, and the type and brand of device involved. Information recorded must protect employee confidentiality.

## Box 3-7

### Key Elements of a Postexposure Medical Evaluation

The employee's blood is tested for HIV in an accredited laboratory.

- The source patient's blood is tested for HIV and HBV, with the patient's permission.
- If the source patient refuses testing, is HBV-positive, or is in a high-risk category, the employee may be given immune globulin or an HBV vaccination.
- If the source patient is HIV-positive, the employee is counseled and tested for HIV infection immediately and at periodic intervals, normally 6 weeks, 12 weeks, 6 months, and 1 year after exposure.

The employee may be given azidothymidine (AZT) or other HIV therapy.

- The exposed employee is counseled to be alert for acute retroviral syndrome (acute viral symptoms) within 12 weeks of exposure.

## Procedure 3-2: Cleanup Procedures for Blood and Other Body Fluid Spills

Type of Spill	Cleanup Procedure
Small spill (a few drops)	Carefully absorb spill with a paper towel or similar material Discard material in biohazard waste container Clean area with appropriate disinfectant
Large spill	Use a special clay or chlorine-based powder to absorb or gel (thicken) the liquid Scoop or sweep up absorbed or thickened material Discard material in a biohazard waste container Wipe spill area with appropriate disinfectant
Dried spills	Moisten spill with disinfectant (avoid scraping, which could disperse infectious organisms into the air) Absorb spill with paper towels or similar material Discard material in biohazard waste container Clean area with appropriate disinfectant
Spills involving broken glass	Wear heavy-duty utility gloves (Never handle broken glass with your hands) Scoop or sweep up material Discard in biohazard sharps container Clean area with appropriate disinfectant



**Key Point** Free confidential medical evaluation following an exposure incident is required by OSHA regulations. If postexposure treatment is recommended, it should be started as soon as possible.

which vary slightly depending upon the type and size of spill (see Procedure 3-2), should concentrate on absorbing the material without spreading it over a wider area than the original spill. Disposable cleanup materials must be discarded in a biohazard waste container. Reusable cleanup materials should be properly disinfected after use.

### SURFACE DECONTAMINATION

OSHA requires surfaces in specimen collection and processing areas to be decontaminated by cleaning them with a 1:10 bleach solution or other disinfectant approved by the **Environmental Protection Agency (EPA)**, a government agency whose mission is to protect health and the environment by implementing and enforcing environmental laws. Bleach solutions should be prepared daily. Cleaning must take place at the end of each shift or whenever a surface is visibly contaminated. Gloves should be worn when cleaning.

### CLEANUP OF BODY FLUID SPILLS

Special EPA-approved chemical solutions and kits are available for cleanup of blood and other body fluid spills and for disinfecting surfaces. Gloves must be worn during the cleaning process. Cleanup procedures,

### BIOHAZARD WASTE DISPOSAL

Nonreusable items contaminated with blood or body fluids are biohazardous waste and must be disposed of in special containers or bags marked with a biohazard symbol. Filled biohazard waste containers require special handling prior to decontamination and disposal. OSHA, EPA, and state and local agencies regulate biohazard waste disposal.

### Electrical Safety

Fire and electrical shock are potential hazards associated with the use of electrical equipment. Knowledge of the proper use, maintenance, and servicing of electrical equipment such as centrifuges can minimize hazards associated with their use. Box 3-8 contains guidelines for electrical safety.

## Box 3-8

### Electrical Safety

- *Avoid* the use of extension cords.
- *Do not* attempt to make repairs to equipment if you are not trained to do so.
- *Do not* handle electrical equipment with wet hands or when standing on a wet floor.
- *Do not* overload electrical circuits.
- *Do not* touch electrical equipment in patient rooms, especially when in the process of drawing blood. An electrical shock could pass through the phlebotomist and the needle and shock the patient.
- *Inspect* cords and plugs for breaks and fraying. Make certain all electrical cords have three-prong plugs and that the third prong (grounding prong) is functional.
- *Know* the location of the circuit breaker box.
- *Unplug* and do not use equipment that is malfunctioning.
- *Unplug* equipment that has had liquid spilled in it. Do not plug in again until the spill has been cleaned up and you are certain the wiring is dry.
- *Unplug* equipment when you are servicing it, including when you are replacing a light bulb.

### Actions to Take If Electrical Shock Occurs

- Shut off the source of electricity.
- If the source of electricity cannot be shut off, use non-conducting material (e.g., hand inside a glass beaker) to remove the source of electricity from the victim.
- Call for medical assistance.
- Start cardiopulmonary resuscitation if indicated.
- Keep the victim warm.

### Fire Safety

All employees of any institution should be aware of procedures to follow in case of fire. They should know where fire extinguishers are located and how to use them. They should know where the fire blankets (Fig. 3-13) are kept and how to use them or heavy towel-eling to smother clothing fires. They should know the location of emergency exits and be familiar with evacuation routes. Fire spreads rapidly and it is important for



**Figure 3-13** Fire blanket storage box.

employees to know the basics of what to do and also what not to do if a fire occurs so they can react quickly and appropriately. Box 3-9 lists dos and don'ts to follow if a fire occurs.



**Test your classes of fire knowledge and express your creativity with color. Do WORKBOOK Matching Exercise 3-3.**

### FIRE COMPONENTS

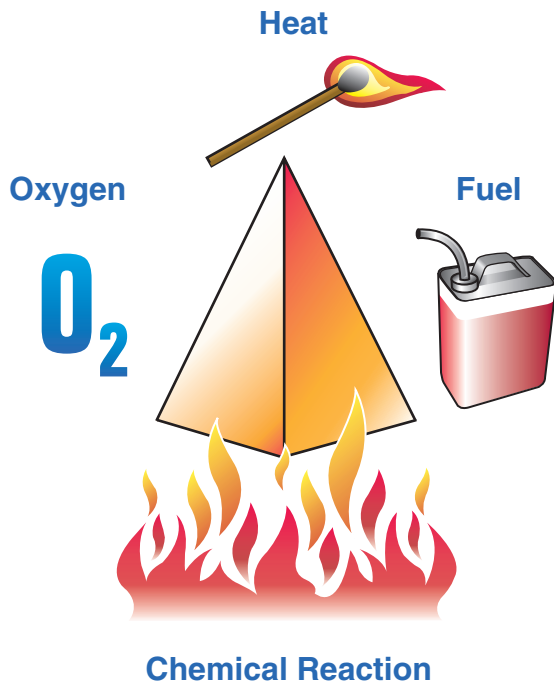
Four components, present at the same time, are necessary for fire to occur. Three of the components, *fuel* (combustible material), *heat* to raise the temperature of the material until it ignites or catches fire, and *oxygen* to

## Box 3-9

### Fire Safety Dos and Don'ts

- Do pull the nearest fire alarm.
- Do call the fire department.
- Do attempt to extinguish a small fire.
- Do close all doors and windows if leaving the area.
- Do smother a clothing fire with a fire blanket or have the person roll on the floor in an attempt to smother the fire.
- Do crawl to the nearest exit if there is heavy smoke present.
- Don't panic.
- Don't run.
- Don't use elevators.

## Fire Tetrahedron



**Figure 3-14** Fire tetrahedron.

maintain combustion or burning have traditionally been referred to as the fire triangle. The fourth component, the chemical reaction that produces fire, actually creates a **fire tetrahedron** (Fig. 3-14). Basic fire safety involves keeping the components apart to prevent fire or removing one or more of the components to extinguish (i.e., put out) a fire. Fire extinguishers work by removing one or more fire components. There are different types of fire extinguishers, depending on the class of fire involved.

### CLASSES OF FIRE

Five classes of fire are now recognized by the **National Fire Protection Association (NFPA)**. Classification is based on the fuel source of the fire. The five classes are as follows:

- *Class A* fires occur with ordinary combustible materials, such as wood, papers, or clothing, and require water or water-based solutions to cool or quench the fire to extinguish it.
- *Class B* fires occur with flammable liquids and vapors, such as paint, oil, grease, or gasoline, and require blocking the source of oxygen or smothering the fuel to extinguish.
- *Class C* fires occur with electrical equipment and require nonconducting agents to extinguish.
- *Class D* fires occur with combustible or reactive metals, such as sodium, potassium, magnesium, and

lithium, and require dry powder agents or sand to extinguish (they are the most difficult fires to control and frequently lead to explosions).

- *Class K* fires occur with high-temperature cooking oils, grease, or fats and require agents that prevent splashing and cool the fire as well as smother it.





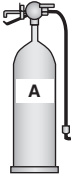
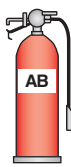
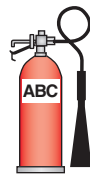



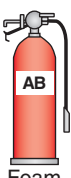
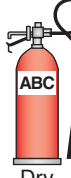
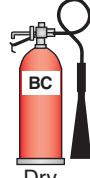
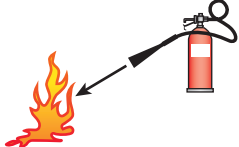


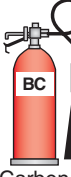
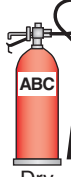

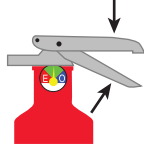


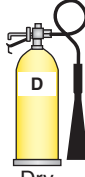
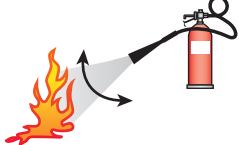



**Memory Jogger** The following are ways to remember each fire classification.

- *Class A* fires occur with ordinary combustible materials; emphasize the “a” when saying the word “ordinary.”
- *Class B* fires occur with flammable liquids; emphasize the “b” when saying the word “flammable.”
- *Class C* fires are electrical fires; emphasize the “c” when saying the word “electrical.”
- *Class D* fires occur with combustible or reactive metals; keep in mind that when you say the word “metal” quickly, it sounds like “medal,” which has a “d” in it, and medals are commonly made of metal.
- *Class K* fires occur with cooking oils or fats in kitchens, which begins with a “k.”

### FIRE EXTINGUISHERS

There is a fire extinguisher class (Fig. 3-15) that corresponds to each class of fire except class D. *Class D* fires present unique problems and are best left to firefighting personnel to extinguish. Using the wrong type of fire extinguisher on a fire can be dangerous. Consequently, some fire extinguishers are multipurpose to eliminate the confusion of having several different types of extinguishers. Multipurpose extinguishers are the type most frequently used in healthcare institutions. Common fire extinguisher classes and how they typically work are as follows:

- *Class A extinguishers* use soda and acid or water to cool the fire.
- *Class B extinguishers* use foam, dry chemical, or carbon dioxide to smother the fire.
- *Class C extinguishers* use dry chemical, carbon dioxide, halon, or other nonconducting agents to smother the fire.
- *Class ABC (multipurpose) extinguishers* use dry chemical reagents to smother the fire. They can be used on class A, B, and C fires.
- *Class K extinguishers* use a potassium-based alkaline liquid specifically formulated to fight high-temperature grease, oil, or fat fires by cooling and smothering them without splashing. Some class K extinguishers can also be used on class A, B, and C fires.

CLASS & SYMBOL	INTENDED USE	ICON	TYPE OF EXTINGUISHER	OPERATION
 Ordinary Combustibles	Fires involving ordinary combustible materials such as cloth, wood, rubber, paper, and many plastics.		 Water  Foam  Dry chemical	 <b>P</b> ULL PIN
 Flammable Liquids	Fires involving flammable liquids and vapors, such as grease, gasoline, oil, and oil-based paints.		 Foam  Dry chemical  Dry chemical	 <b>A</b> IM NOZZLE
 Electrical Equipment	Fires involving electrical equipment such as appliances, tools, or other equipment that is plugged into an electricity source.		 Carbon dioxide  Dry chemical  Dry chemical	 <b>S</b> QUEEZE TRIGGER
 Combustible Metals	Fires involving combustible, reactive, or flammable metals.		 Dry powder	 <b>S</b> WEEP NOZZLE
 Cooking Oils	Fires involving high temperature cooking oils, grease or fat such as vegetable oils, animal oils, or fats typically found in commercial kitchens.		 Potassium-based alkaline liquid	

**Figure 3-15** Classes of fire extinguishers. (Symbols reprinted with permission from NFPA 10, Portable Fire Extinguishers, Copyright © 2007, National Fire Protection Association. This reprinted material is not the complete and official position of the NFPA on the referenced subject, which is represented only by the standard in its entirety.)



**Memory Jogger** The NFPA code word for the order of action in the event of fire is

RACE, where the letters stand for the following:

R = *Rescue* individuals in danger.

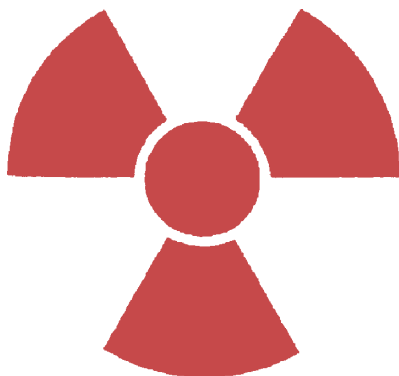
A = *Alarm*: activate the fire alarm.

C = *Confine* the fire by closing all doors and windows.

E = *Extinguish* the fire with the nearest suitable fire extinguisher.

## Radiation Safety

The principles involved in radiation exposure are *distance*, *shielding*, and *time*. This means that the amount of radiation you are exposed to depends upon how far you are from the source of radioactivity, what protection you have from it, and how long you are exposed to it. Exposure time is important because radiation effects are cumulative.



**Figure 3-16** The radiation hazard symbol.



**Key Point** Those working in areas where there may be high levels of radioactivity are required to wear a dosimeter badge, which records accumulated radiation exposure. Badge readings must be checked by the appropriate authority at regular intervals.

A clearly posted **radiation hazard symbol** (Fig. 3-16) is required in areas where radioactive materials are used and on cabinet or refrigerator doors where radioactive materials are stored. In addition, radioactive reagents and specimens must be labeled with a radiation hazard symbol. A radiation hazard symbol on a patient's door signifies that a patient has been treated with radioactive isotopes.

A phlebotomist may encounter radiation hazards when collecting specimens from patients who have been injected with radioactive dyes, when collecting specimens from patients in the radiology or nuclear medicine departments, and when delivering specimens to radioimmunoassay sections of the laboratory. The phlebotomist should be aware of institutional radiation safety procedures, recognize the radiation hazard symbol, and be cautious when entering areas where the symbol is displayed.



**CAUTION** Because radiation is particularly hazardous to a fetus, pregnant employees should avoid areas displaying the radiation symbol, patients who have recently been injected with radioactive dyes, and specimens collected from patients while radioactive dye is still in their systems.

## Chemical Safety

A phlebotomist may come in contact with hazardous chemicals when using cleaning reagents, adding preservatives to 24-hour urine containers, or delivering specimens

### Box 3-10

#### General Rules for Chemical Safety

- *Always* wear proper protective clothing—including lab coat, apron, gloves, and safety goggles—when working with chemicals.
- *Always* use proper chemical cleanup materials when cleaning up chemical spills.
- *Never* store chemicals above eye level.
- *Never* add water to acid.
- *Never* indiscriminately mix chemicals together.
- *Never* store chemicals in unlabeled containers.
- *Never* pour chemicals into dirty containers, especially containers previously used to store other chemicals.
- *Never* use chemicals in ways other than their intended use.

to the laboratory. Inappropriate use of chemicals can have dangerous consequences. For example, mixing bleach with other cleaning compounds can release dangerous gases. In addition, many chemicals are potent acids, such as the hydrochloric acid (HCl) used as a urine preservative, or alkalis, both of which can cause severe burns. Container labels provide important information regarding the contents and should always be read carefully before use. See Box 3-10 for general chemical safety rules.



**CAUTION** An important chemical safety rule to remember when dealing with acids and other liquids is *never* add water or other liquids to an acid, as it can cause an explosive type reaction. If a mixture containing both is to be made, always add the acid to the other liquid.



**Memory Jogger** Think of the letters “AAA” to remember the safety rule “always add acid.”

### OSHA HAZARD COMMUNICATION STANDARD

OSHA developed the **Hazard Communication (HazCom) Standard (HCS)** to protect employees who may be exposed to hazardous chemicals. According to

## Box 3-11

## GHS Elements Incorporated into the Hazcom Standard Update

1. Harmonized signal word: one of two new signal words to specify the severity of the hazard; “Danger” if the hazard is severe, or “Warning” if the hazard is less severe.
2. GHS pictogram: a symbol with other graphic elements (e.g., a border, background pattern, or color) meant to communicate specific information about the hazard. An individual pictogram is a symbol on a white background within a red diamond-shaped frame
3. Hazard statement: a statement for each class and category that describes the nature of the hazard, and the hazard degree, if applicable.
4. Precautionary statement: a statement describing measures to take to minimize or prevent adverse effects of exposure or improper handling or storage.
5. Supplier identification: name, address, and phone number of manufacturer or supplier

the law, all chemicals must be evaluated for health hazards, and all chemicals found to be hazardous must be labeled as such and the information communicated to employees. The HCS was recently revised to align it with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) that is being promoted for use worldwide. The intent of the revised HCS standard is to increase employee safety by providing consistent, easily understandable information concerning the safe handling and use of hazardous chemicals. Important GHS elements that will have been incorporated into the Hazcom Standard label requirements by June 1, 2016 are shown in Box 3-11.



**Key Point** The HCS is known as “the right to know” law because the labeling requirement gives employees the right to know about chemical hazards they encounter in the workplace. The GHS changes to the HCS now give employees the ability to better understand the chemical hazards they may face.

Major HCS changes include the following:

- Specific criteria for classification of health and physical hazards.
- New labeling requirements
- New **safety data sheet (SDS)** requirements
- Required employee training in the new label elements and SDS format



Implementation of the revised standard is expected to prevent over 500 workplace injuries and illnesses and 43 fatalities, and also save costs to businesses.

### HazCom Labeling Requirements

All chemical manufacturers must comply with GHS labeling requirements. In addition to the identity of a chemical, the label of a hazardous chemical must include a precautionary statement and a GHS hazard statement, signal word, and **pictogram** for each hazard class and category. A signal word specifies the severity of the hazard faced. There are two GHS signal words: “Danger” if the hazard is severe, or “Warning” if the hazard is less severe. A pictogram is an easily recognized and universally accepted symbol that alerts users to the type of chemical hazard they may face. The pictograms are diamond-shaped, framed with a red border, and have a white background on which the symbol is displayed. The revised HCS designates eight specific GHS hazard category pictograms for use on labels (Fig. 3-17).









There is a ninth pictogram for environmental hazards. It is not required by OSHA because environmental hazards are not within OSHA’s jurisdiction.

### Safety Data Sheets

In addition to the labeling requirement, the revised HCS requires chemical manufacturers, distributors, or importers to supply customers with a GHS standardized 16 section **safety data sheet (SDS)** (formerly called an MSDS or material safety data sheet) for every hazardous chemical. Like the MSDS the new SDS communicates general and precautionary information about the hazard to users. However, the information will now be consistent for every chemical manufacturer or distributor in that the headings of information sections and the order the sections are presented will always be the same. The required SDS sections are shown in Box 3-12.

## HCS Pictograms and Hazards

<p style="text-align: center;"><b>Health Hazard</b></p>  <ul style="list-style-type: none"> <li>▪ Carcinogen</li> <li>▪ Mutagenicity</li> <li>▪ Reproductive Toxicity</li> <li>▪ Respiratory Sensitizer</li> <li>▪ Target Organ Toxicity</li> <li>▪ Aspiration Toxicity</li> </ul>	<p style="text-align: center;"><b>Flame</b></p>  <ul style="list-style-type: none"> <li>▪ Flammables</li> <li>▪ Pyrophorics</li> <li>▪ Self-Heating</li> <li>▪ Emits Flammable Gas</li> <li>▪ Self-Reactives</li> <li>▪ Organic Peroxides</li> </ul>	<p style="text-align: center;"><b>Exclamation Mark</b></p>  <ul style="list-style-type: none"> <li>▪ Irritant (skin and eye)</li> <li>▪ Skin Sensitizer</li> <li>▪ Acute Toxicity</li> <li>▪ Narcotic Effects</li> <li>▪ Respiratory Tract Irritant</li> <li>▪ Hazardous to Ozone Layer (Nonmandatory)</li> </ul>
<p style="text-align: center;"><b>Gas Cylinder</b></p>  <ul style="list-style-type: none"> <li>▪ Gases Under Pressure</li> </ul>	<p style="text-align: center;"><b>Corrosion</b></p>  <ul style="list-style-type: none"> <li>▪ Skin Corrosion/Burns</li> <li>▪ Eye Damage</li> <li>▪ Corrosive to Metals</li> </ul>	<p style="text-align: center;"><b>Exploding Bomb</b></p>  <ul style="list-style-type: none"> <li>▪ Explosives</li> <li>▪ Self-Reactives</li> <li>▪ Organic Peroxides</li> </ul>
<p style="text-align: center;"><b>Flame Over Circle</b></p>  <ul style="list-style-type: none"> <li>▪ Oxidizers</li> </ul>	<p style="text-align: center;"><b>Environment (Nonmandatory)</b></p>  <ul style="list-style-type: none"> <li>▪ Aquatic Toxicity</li> </ul>	<p style="text-align: center;"><b>Skull and Crossbones</b></p>  <ul style="list-style-type: none"> <li>▪ Acute Toxicity (fatal or toxic)</li> </ul>

**Figure 3-17** HCS hazard category pictograms.

## Box 3-12

### SDS Sections

#### Sections required by OSHA:

- *Section 1. Identification*—will include the product identifier, how the chemical is to be used and any restrictions, the supplier's contact information plus an emergency phone number.
- *Section 2. Hazard Identification*—will include the GHS classification of the substance and the pictogram or the name of the symbol.
- *Section 3. Composition and Information on Ingredients*—will include the chemical identity, its common name and synonyms, and the chemical abstract service (CAS) number.
- *Section 4. First Aid Measures*—will describe routes of exposure such as inhalation, skin and eye contact, and ingestion. It also will indicate any immediate medical attention and special treatment that is needed.
- *Section 5. Fire-fighting Measures*—will include extinguishing media and special protective equipment and precautions for fire fighters.
- *Section 6. Accidental Release Measures*—will include emergency procedures and any environmental precautions, including methods and materials for containment and cleaning up.
- *Section 7. Handling and Storage*—will include the safe handling and storage of the chemical including any incompatibilities.
- *Section 8. Exposure Controls/Personal Protection*—will include occupational or biological exposure limit values, engineering controls, and personal protective equipment.
- *Section 9. Physical and Chemical Properties*—will include the chemical appearance, melting or freezing point, boiling range, flash point, evaporation rate, flammability, vapor pressure and density, solubility, and autoignition and decomposition temperatures.
- *Section 10. Stability and Reactivity*—will describe the chemical's stability. It will also indicate conditions to avoid such as static discharge, shock or vibration, incompatible materials, and hazardous decomposition products.
- *Section 11. Toxicological Information*—will include a description of the toxicological effects of the chemical including routes of exposure, symptoms related to the physical, chemical, and toxicological characteristics, as well as effects from short- and long-term exposure.

#### Sections that may be included, but are not required by OSHA:

- *Section 12. Ecological Information*—will include ecotoxicity, persistence, and degradability, bioaccumulative potential, mobility in soil, and any other adverse effects.
- *Section 13. Disposal Considerations*—will include a description of the waste residues, their safety handling, and the disposal of any contaminated packaging.
- *Section 14. Transport Information*—will include the United Nations (UN) number, the United States proper shipping name, hazard classes, packing group, if applicable, if it is a marine pollutant and any special precautions for transport or conveyance either within or outside the facility's premises.
- *Section 15. Regulatory Information*—will include safety, health, and environmental regulations for the chemical.
- *Section 16. Other Information*—may include any relevant information that is not covered by the other 15 sections and may include the date of preparation or last revision of the SDS.



**Key Point** Employers are required to obtain the SDS of every hazardous chemical present in the workplace and to make all SDSs readily accessible to employees either by electronic means or hard copy.

### DEPARTMENT OF TRANSPORTATION LABELING SYSTEM

Hazardous materials may have additional labels of precaution, including a Department of Transportation (DOT) symbol incorporating a United Nations hazard classification number and symbol (Table 3-3). The DOT labeling



**Figure 3-18** Example of a DOT hazardous material label.

system uses a diamond-shaped warning sign (Fig. 3-18) containing the United Nations hazard class number, the hazard class designation or four-digit identification number, and a symbol representing the hazard.

## NATIONAL FIRE PROTECTION ASSOCIATION LABELING SYSTEM

Another hazardous material rating system (Fig. 3-19) was developed by the NFPA to label areas where hazardous chemicals and other materials are stored, thus alerting firefighters in the event of a fire. This system uses a diamond-shaped symbol divided into four quadrants. Health hazards are indicated in a blue diamond on the left, the level of fire hazard is indicated in the upper quadrant in a red diamond, stability or reactivity hazards are indicated in a yellow diamond on the right, and other specific hazards are indicated in a white quadrant on the bottom.

## SAFETY SHOWERS AND EYEWASH STATIONS

The phlebotomist should know the location of and be instructed in the use of safety showers and eyewash stations (Fig. 3-20) in the event of a chemical spill or splash to the eyes or other body parts. The affected parts should be flushed with water for a minimum of 15 minutes, followed by a visit to the emergency room for evaluation.

## CHEMICAL SPILL PROCEDURES

Chemical spills require cleanup using special kits (Fig. 3-21) containing absorbent and neutralizer materials. The type of materials used depends upon the type of chemical spilled. An indicator in the cleanup materials detects when the materials have been neutralized and are safe for disposal. The EPA regulates chemical disposal.

## First Aid

The ability to recognize and react quickly and skillfully to emergency situations may mean the difference between life and death for a victim. First aid is something that can usually be carried out by a bystander with minimal or even no supplies or medical equipment.



**Do you know the meaning of the elements that make up the word hemorrhage? Test yourself with WORKBOOK Skills Drill 3-2.**

## External Hemorrhage

According to current American Red Cross guidelines, hemorrhage (abnormal or profuse bleeding) from an obvious wound can be effectively controlled by firmly applying direct pressure to the wound until bleeding stops or EMS rescuers arrive. Pressure should be applied using cloth or gauze, with additional material added if bleeding continues. It is acceptable to use an elastic bandage to hold the compress in place as long as pressure is applied to the bandage. Standard precautions should be followed.

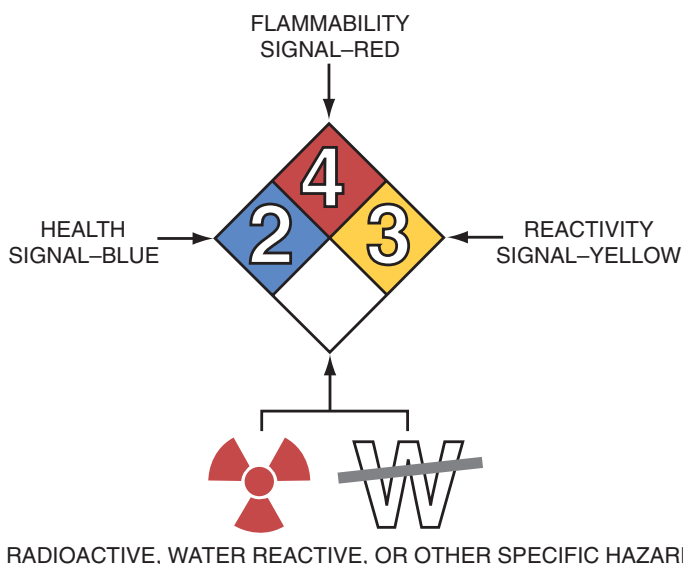


**CAUTION** The original compress should not be removed when adding additional ones because removal can disrupt the clotting process.

Previous guidelines added elevating the affected part above the level of the heart and, if efforts to control bleeding were ineffective, use of arterial pressure points. The effects of elevation have not been studied and pressure points have been found to have little effect. Consequently these procedures are no longer recommended. Using a tourniquet to control bleeding can be harmful and is also not recommended. A tourniquet should be used only as a last resort to save a life after all other means to control bleeding are unsuccessful, as may occur with an **avulsion** (a tearing away or amputation of a body part) or a severely mangled or crushed body part.

## Shock

A state of shock results when there is insufficient return of blood flow to the heart, resulting in an inadequate supply of oxygen to all organs and tissues of the body. Numerous conditions including hemorrhage, heart attack, trauma, and drug reactions can lead to some degree of shock. Because shock can be a life-threatening situation, symptoms must be recognized and dealt with immediately.



Identification of Health Hazard Color Code: <b>BLUE</b>		Identification of Flammability Color Code: <b>RED</b>		Identification of Reactivity (Stability) Color Code: <b>YELLOW</b>	
	Type of possible injury		Susceptibility of materials to burning		Susceptibility to release of energy
<b>SIGNAL</b>		<b>SIGNAL</b>		<b>SIGNAL</b>	
<b>4</b>	Materials that on very short exposure could cause death or major residual injury even though prompt medical treatment was given.	<b>4</b>	Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or that are readily dispersed in air and that will burn readily.	<b>4</b>	Materials that in themselves are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
<b>3</b>	Materials that on short exposure could cause serious temporary or residual injury even though prompt medical treatment was given.	<b>3</b>	Liquids and solids that can be ignited under almost all ambient temperature conditions.	<b>3</b>	Materials that in themselves are capable of detonation or explosive reaction but require a strong initiating source or that must be heated under confinement before initiation or that react explosively with water.
<b>2</b>	Materials that on intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given.	<b>2</b>	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.	<b>2</b>	Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. Also, materials that may react violently with water or that may form potentially explosive mixtures with water.
<b>1</b>	Materials that on exposure would cause irritation but only minor residual injury even if no treatment is given.	<b>1</b>	Materials that must be preheated before ignition can occur.	<b>1</b>	Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures or that may react with water with some release of energy, but not violently.
<b>0</b>	Materials that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.	<b>0</b>	Materials that will not burn.	<b>0</b>	Materials that in themselves are normally stable, even under fire exposure conditions, and that are not reactive with water.

**Figure 3-19** National Fire Protection Association 704 marking system example and explanation.

### COMMON SYMPTOMS OF SHOCK

It is important to be able to recognize the symptoms of shock in order to respond quickly and appropriately. Common symptoms of shock include:

- Pale, cold, clammy skin
- Rapid, weak pulse
- Increased, shallow breathing rate
- Expressionless face and staring eyes



**Figure 3-20** Combination safety shower and eyewash.

## FIRST AID FOR SHOCK

When providing first aid to a victim of shock, be sure to do the following:

1. Maintain an open airway for the victim.
2. Call for assistance.
3. Keep the victim lying down with the head lower than the rest of the body.



**Figure 3-21** Spill cleanup kit.

4. Attempt to control bleeding or other cause of shock if known.
5. Keep the victim warm until help arrives.



**CAUTION** Never give fluids if the patient is unconscious or semiconscious or has injuries likely to require surgery and anesthesia.

## Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Most healthcare institutions require their personnel to be certified in cardiopulmonary resuscitation (CPR). Consequently, most phlebotomy programs require it as a prerequisite or corequisite or include it as part of the course. The American Heart Association (AHA) recommends the 6- to 8-hour Basic Life Support (BLS) Healthcare Provider Course for those in healthcare professions. The course includes instruction in how to perform CPR on victims of all ages, use of an automated external defibrillator (AED), and how to remove a foreign body airway obstruction. Certification is good for 2 years.

### AMERICAN HEART ASSOCIATION CPR AND ECC GUIDELINES

The current AHA guidelines for CPR and Emergency Cardiovascular Care (ECC) aim to simplify lay rescuer training, and stress the need for early chest compressions for victims of sudden cardiac arrest. Untrained bystanders are now encouraged to provide Hands-Only™ (compressions only) CPR. Trained lay rescuers, if able, still provide compressions and ventilations; however, the latest guidelines call for them to start chest compressions before opening the airway or initiating rescue breathing. Consequently, the previous ABCs (airway, breathing, compressions) of CPR taught in BLS courses have been replaced with CAB (compressions, airway, breathing), except for CPR on newborns. The guidelines also place increased emphasis on high-quality CPR that includes:

A compression rate of at least 100 per minute (formerly it was *approximately* 100 per minute)

An adult compression depth of at least 5 cm (2 inches)

An infant and child compression depth is one-third of the anterior–posterior diameter of the chest; approximately 4 cm (1.5 inches) for infants and 5 cm (2 inches) for children

Allowing complete chest recoil between compressions

Minimizing interruptions in chest compressions (trying to limit them to less than 10 seconds)

Avoiding excessive ventilation (BLS single rescuer compression-to-ventilation ratio stays at 30:2)

## AHA ECC ADULT CHAIN OF SURVIVAL

The AHA ECC adult chain of survival is a five-step course of action used to aid victims of sudden cardiac arrest that can optimize their chance of survival and recovery. The links in the chain are:

1. Immediate **recognition** of cardiac arrest and activation of the emergency response system
2. Early **CPR** with an emphasis on chest compressions
3. Rapid **defibrillation**
4. Effective **advanced life support**
5. Integrated **postcardiac arrest care**

## Personal Wellness

*“The doctor of the future will give no medicine but will interest his patients in the care of the human frame, in diet, and in the cause and prevention of disease.”*

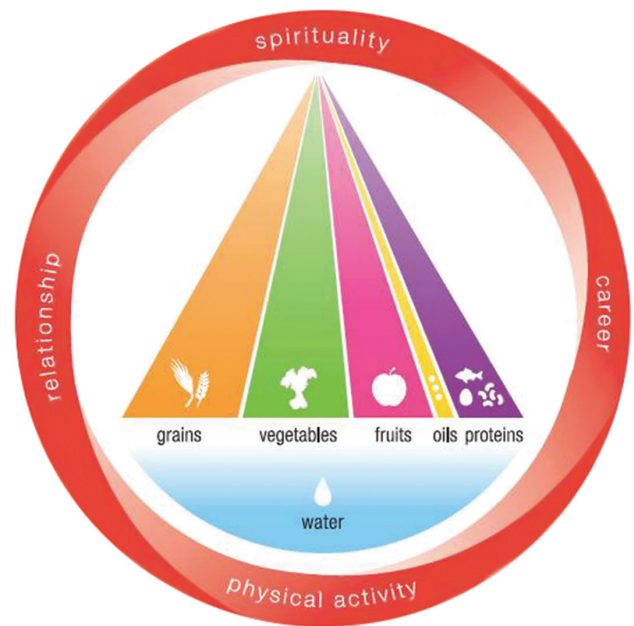
—Thomas Edison

Today, personal wellness is more popular than ever. It seems as if wellness businesses are popping up on every street corner, and small to large companies are seeing the value in implementing wellness programs. Personal wellness is not just about what you eat, it requires a holistic approach, one that meets the physical, emotional, social, spiritual, and economic needs. Integrative Nutrition, the world’s largest nutrition school, offers a Food Pyramid that incorporates this holistic approach to wellness (Fig. 3-22).



Holistic comes from the Greek word *Holos*, which means *to heal*.

Our most serious health threats today are chronic illnesses such as heart disease or cancer—diseases that we have the power to prevent. The good news is that prevention has become a greater focus now than ever before. Insurance plans must now provide free preventive services to all members as part of Health Care Reform. By taking aim at prevention and creating a well balanced life through knowledge, self-awareness and self-care, personal wellness is something most everyone can achieve.



**Figure 3-22** Holistic food pyramid. © 2007–2012 Integrative Nutrition, Inc. Reprinted with permission. No further copying and/or republication is permitted.

## Proper Nutrition

*“Let thy food be thy medicine, and thy medicine be thy food.”*

—Hippocrates, the father of medicine, 500 B.C.

Nutrition has been defined as the “act or process of nourishing.” In other words, a food is nutritious if it supplies the nutrients the body needs “to promote growth and repair and maintain vital processes.” The basic purpose of nutrition is to keep us alive, but more importantly, good nutrition provides what the body needs for energy and day-to-day functioning.

Physical health requires eating well. In this fast-paced world, few of us receive the nutrition we need. Much of the food found on the shelves of a typical American grocery store is so highly processed and chemically altered that it has very little nutritional value and does not promote healthy bodies. The American Institute for Cancer Research (AICR) has published a recommended diet to reduce the risk of cancer. They suggest that a person choose a predominantly plant-based diet rich in a variety of vegetables, fruits, legumes, and minimally processed starchy staple foods. A healthy diet contains the widest possible variety of natural foods. It provides a good balance of carbohydrates, fat, protein, vitamins, minerals, and fiber.



**Key Point** In general, it is best to eat whole foods in their natural state. Avoid processed foods with chemical additives or sweeteners as much as possible.

## Rest and Exercise

Personal wellness requires a nutritious diet, exercise, and getting the right amount of rest. Healthcare workers often complain of fatigue (physical or mental exhaustion). Fatigue brought on by physical causes is typically relieved by sleep. Lack of rest and sleep can lead to medical problems. The typical frantic pace in healthcare facilities today makes it especially important to get the required hours of sleep and to take breaks during the day to rest, refresh, and stay fit. With smart phones occupying free moments and allowing us to take our work everywhere, there seem to be very few moments of peace, quiet, and relaxation even when not at work.

Studies show that being physically fit increases the chance of staying healthy and living longer. The most accurate measurements of fitness consist of evaluating three components—strength (the ability to carry, lift, push, or pull a heavy load), flexibility (the ability to bend, stretch, and twist), and endurance (the ability to maintain effort for an extended period of time). Some activities, such as the increasingly popular sport of cycling (Fig. 3-23), incorporate all of those components and is a great way to pedal away workplace stress. No single measurement of performance classifies a person as fit or unfit. If a person becomes breathless after climbing a flight of stairs or hurrying to catch a bus but is otherwise healthy, clearly he or she could benefit from some form of conditioning or exercise.

Exercise contributes to improved quality of life on a day-to-day basis. It strengthens the immune system, increases energy, and reduces stress by releasing substances called endorphins, which create a peaceful state. People who exercise tend to relax more completely, even when under stress. Regular physical activity also appears to reduce symptoms of depression and anxiety and to increase the ability to perform daily tasks. Walking requires no special equipment and is a form of exercise that can easily be incorporated into almost anyone's life.



**Figure 3-23** Cyclists compete in road race.



**Key Point** According to the American Heart Association if activity during work is low to moderate, a 30-minute brisk walk or similar exercise daily can improve blood pressure, and reduce the risk of heart disease and type 2 diabetes.

Weight training is suggested as an excellent strength exercise. Studies have shown that using weights can build bone mass, even in the very elderly. Using your own body as a weight by doing push ups, pull ups, or wall sits is an easy way to weight train without equipment. For flexibility, yoga and Pilates are two forms of exercise that emphasize bending, stretching, and twisting. In choosing an exercise activity, it is most important is to pick one that is enjoyable so that you will be more apt to do it routinely.

## Personal Hygiene

Personal wellness includes good personal hygiene. Personal hygiene communicates a strong impression about an individual. It is important to shower or bathe and use deodorant on a regular basis. Teeth should be brushed and mouthwash used more than once a day if possible. Hair should be clean and neatly combed. Fingernails should be clean, short, and neatly trimmed. A fresh, clean appearance without heavily scented lotions or colognes portrays health and instills confidence in employees and their patients and employers as well.

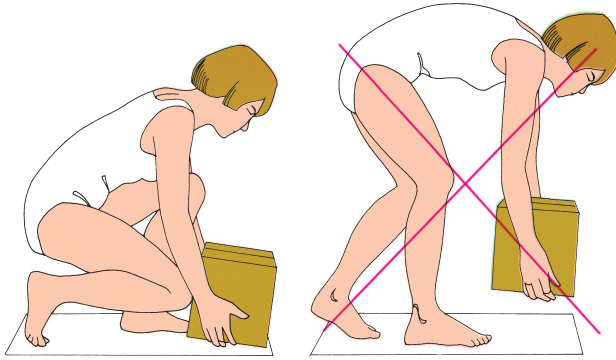


**Key Point** Phlebotomists should pay special attention to personal hygiene not only for optimal health, but also because their job involves close patient contact.

**thePoint** View the *Poor and Good Workplace Ergonomics for Phlebotomy and Proper Lifting Technique* videos at <http://thepoint.lww.com/McCall6e>.

## Back Protection

To lead an active and healthy life, you need a healthy back. The spine is designed to withstand everyday movement, including the demands of exercise. Improper lifting and poor posture habits, however, can cause weaknesses. It is estimated that back injuries account for approximately 20% of all workplace injuries and



**Figure 3-24** Lifting techniques.

illnesses. Lower back pain is a costly health problem that affects both industry and society in general. Strategies to prevent back injuries include instruction concerning back mechanics and lifting techniques (Fig. 3-24), lumbar support, and exercise. Exercise promotes strong backs; it improves back support and directly benefits the disks in the spinal column. Stress can make a person vulnerable to back problems because of muscle spasms. Keeping back muscles flexible with exercise can alleviate this stress reaction.



**Key Point** Healthcare workers are at risk for back injury because of activities they are required to do (e.g., lift and move patients) and because of the stressful environment often associated with healthcare today.

## Stress Management

Stress is a condition or state that results when physical, chemical, or emotional factors cause mental or bodily tension. It challenges our ability to cope or adapt. Stress is sometimes useful, keeping us alert and increasing our energy when we need it. Persistent or excessive stress, on the other hand, can be harmful.

Evidence suggests that “negative stress” (such as an emergency or an argument) has a damaging effect on personal wellness. Stressful situations are more likely to be damaging if they cannot be predicted or controlled. This fact is particularly apparent where job stress is concerned. Highly demanding jobs are much more stressful

## Box 3-13

### Ways to Control Stress

- Identify your problem and talk about it with a close friend, partner, or the person at the source of the problem.
- Learn to relax throughout the day—close your eyes, relax your body, and clear your mind.
- Exercise regularly—develop a consistent exercise routine that you can enjoy.
- Avoid making too many changes at once—plan for the future to avoid simultaneous major changes.
- Spend at least 15 minutes a day thoroughly planning the time you have.
- Set realistic goals—be practical about what you can accomplish.
- Avoid procrastination by tackling the most difficult job first.

if an individual has no control over the workload, as is often the case in healthcare. Stress is more likely to have adverse effects on an individual if social support is lacking or there are personal or financial concerns. Although the signs of stress may not be immediately apparent, different organs and systems throughout the body are being affected. The immune system may be weakened, and other symptoms such as hypertension, ulcers, migraines, and nervous breakdowns may eventually result.

In today’s hectic lifestyle and especially in healthcare environment, it is necessary to manage stress to maintain personal wellness. Box 3-13 lists ways to deal with stress.



**Key Point** The easiest way to reduce stress in the moment is to pause wherever you are and take three deep and mindful breaths. Deep breathing has a positive effect on the nervous system and relaxes the body.

## Study and Review Questions

 See the **EXAM REVIEW** for more study questions.

- Which of the following situations involves an HAI?**
  - A man has a bladder infection upon hospital admission.
  - An employee contracts hepatitis B from a needlestick.
  - A patient in ICU has an incision that becomes infected.
  - A baby in the nursery has a congenital herpes infection.
- Reverse isolation may be used for**
  - a patient with the measles.
  - an adult patient with the flu.
  - a patient with tuberculosis.
  - a patient with severe burns.
- The single most important means of preventing the spread of infection is**
  - proper hand antisepsis.
  - keeping clothes clean.
  - wearing a mask.
  - wearing gloves.
- The most frequently occurring lab-acquired infection is**
  - hepatitis B.
  - HIV infection.
  - syphilis.
  - tuberculosis.
- To destroy transient microorganisms when washing hands, use**
  - antiseptic soap.
  - bleach solution.
  - plain soap.
  - all of the above.
- In the event of a body fluid splash to the eyes, the victim should immediately**
  - call 911 so the paramedics will come.
  - flush eyes with water for 10 minutes.
  - go to the emergency room.
  - wipe the eyes with a tissue.
- Which of the following items is PPE?**
  - Biohazard bag
  - Countertop shield
  - Nonlatex gloves
  - Sharps container
- Which of the following examples of potential exposure to blood-borne pathogens involves a parenteral route of transmission?**
  - Chewing gum while collecting blood specimens
  - Eating a snack while accessing specimens
  - Licking fingers while turning lab manual pages
  - Rubbing the eyes while processing specimens
- Surfaces in the specimen collection and processing area should be cleaned with**
  - 70% isopropyl alcohol.
  - 1:10 bleach solution.
  - soap and water.
  - any of the above.
- Which of the following is a proper way to clean up a small blood spill that has dried on a countertop?**
  - Moisten it with a disinfectant and carefully absorb it with a paper towel.
  - Rub it with an alcohol pad, then wipe the area with a clean alcohol pad.
  - Scrape it into a biohazard bag and wash the surface with soap and water.
  - Use a disinfectant wipe and scrub it in ever-increasing concentric circles.
- Distance, time, and shielding are principles of**
  - BBP safety.
  - electrical safety.
  - fire safety.
  - radiation safety.
- Safe working conditions are mandated by**
  - CDC.
  - HazCom.
  - HICPAC.
  - OSHA.
- A globally harmonized signal word signifies the**
  - identity of the chemical.
  - reactivity of the chemical.
  - severity of a hazard faced.
  - type of hazard involved.

**14. According to the HAI prevalence survey the most common HAI pathogen is**

- Acinetobacter baumannii.*
- Clostridium difficile.*
- Mycobacterium tuberculosis.*
- Staphylococcus aureus.*

**15. When exiting an isolation room, this item of PPE must be removed outside the room.**

- Gloves
- Gown
- Mask
- Respirator

## Case Studies

 See the **WORKBOOK** for more case studies.

### Case Study 3-1: An Accident Waiting to Happen

A female blood drawer works alone in a clinic. It is almost time to close for lunch when a patient arrives for a blood test. The blood drawer is flustered because she has a special date for lunch. She is dressed up for the occasion, wearing a nice dress and high heels. She looks nice except for a large scratch on her left wrist, which she got while playing with her cat that morning. She quickly draws the patient's blood. As she turns to put the specimen in a rack, she slips and falls, and one of the tubes breaks. She does not get cut, but blood splashes everywhere, including on her left wrist.

#### QUESTIONS

- What is the first thing the phlebotomist should do?
- How did the phlebotomist's actions contribute to this accident?
- What should she have done that might have prevented the exposure, despite the tube breaking?
- What type of exposure did she receive?

### Case Study 3-2: Hitch-Hiking Microbes

You are one of only two phlebotomists working this holiday. You are very busy and hardly have time to sanitize your hands, much less remember to put your lab coat back on over your scrubs for every draw. Besides, you are too warm with it on. Everyone you have drawn in the ER today seems to have the flu or some sort of diarrhea or stomach issue. As soon as your shift is over, you head straight home. No time to change clothes before you have to fix dinner for the family, but you do take a few minutes to throw your feet up in the recliner and relax. Your 18-month old, Daren, crawls onto your lap to snuggle. Four days later Daren ends up at Urgent Care because diarrhea and vomiting have made him very dehydrated.

#### QUESTIONS

- Daren's illness is similar to those of the ER patients. Why might this be?
- If the contamination came from an ER patient, identify three ways his illness could have been avoided.
- Would this be considered an HAI?



**Time to try your luck at the crossword in the WORKBOOK.**

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## MEDIA MENU

### Online Ancillaries (at <http://thepoint.lww.com/McCall6e>)

- Videos:
  - Donning and Removal of Protective Equipment
  - Hand Washing/Hand Antisepsis
  - Poor and Good Workplace Ergonomics for Phlebotomy
  - Proper Lifting Technique
- Interactive exercises and games, including Look and Label, Word Building, Body Building, Roboterms, Crossword Puzzles, Quiz Show, and Concentration
- Audio flash cards and flashcard generator
- Audio glossary

### Internet Resources

- College of American Pathologists: <http://www.cap.org>
- National Fire Protection Association: <http://www.nfpa.org>
- OSHA's Hazard Communication website: <http://www.osha.gov/dsg/hazcom/index.html>
- Occupational Safety and Health Administration: <http://www.osha.gov/dcsp/osp/statestandards.html>
- Occupational Safety and Health Administration: <http://www.osha.gov/hospitals>
- <http://www.osha.gov/dcsp/osp/statestandards.html>
- U.S. Department of Health and Human Services, Centers for Disease Control and Prevention: <http://www.cdc.gov>
- U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings: <http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/Isolation2007.pdf>

### Other Resources

- McCall R, Tankersley C. *Student Workbook for Phlebotomy Essentials, 6th ed.* (Available for separate purchase).
- McCall R, Tankersley C. *Phlebotomy Exam Review, 6th ed.* (Available for separate purchase).