EMPLOYEE HANDOUT

INFECTION CONTROL

Employer: __________________________

Trainer: ____________________________

Employee: __________________________

Date: ______________________________

Chapter 4  Infection Control

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By the middle of the 20th century, it had begun to look as though humanity had infectious diseases whipped. With antibiotics to tame bacterial infections and vaccinations capable of wiping out entire diseases (smallpox was globally eradicated from the human population in 1969), we had turned our attention to diseases with more complex causes—cancer and heart disease, diabetes, and diseases of aging such as Alzheimer’s and Parkinson’s disease.

Then infectious diseases started making a comeback. Bacterial diseases like tuberculosis developed resistance to antibiotics that had once been effective. Overuse of antibiotics—in animal feed and in treating viruses without effect—contributed to the decline. By the end of the century, multiple-drug-resistant tuberculosis was widespread, and common bacteria, such as Staphylococci and Streptococci, were developing resistance to methicillin and vancomycin, the antibiotics of last resort.

Viral diseases staged a comeback, too. HIV was first identified in 1981; hepatitis C was identified in 1989. These newly identified viruses had their own defenses against our weapon of choice—vaccination. They mutate frequently, changing their identifying proteins so that they become unrecognizable to the immune system. Other viruses, like the flu viruses, now mutate so quickly into so many new strains that it is difficult to design vaccines that can keep up.

In this era of resurgent infectious diseases, confining and controlling the spread of infections becomes an important consideration for health care workers—both for the sake of patients who may be susceptible to secondary infections as well as for the workers’ own sake. Health care workers, after all, are the people who deal directly with these new “superbugs.” According to an analysis conducted by the Bureau of Labor Statistics using 2009 data, health care and social assistance workers accounted for more than 1 in 4 occupational illness cases reported among private industry establishments, including more than 32% of work-related respiratory illnesses. The rate at which respiratory illnesses occurred in this sector was more than twice that of private industry—3.8 cases versus 1.6 cases per 10,000 full-time workers. More than half of these respiratory illnesses were reported in hospitals, where the rate of work-related respiratory illnesses was 7.2 per 10,000 workers—more than four times the rate for all private industries. Infection control is an issue not just of patient care, but of worker safety, too.
Remember the story of Typhoid Mary? Her real name was Mary Mallon, and she was an immigrant who worked as a cook for wealthy families in New York in the late nineteenth and early twentieth centuries. When six families for whom she had cooked suffered attacks of typhoid fever, Mary was identified as the source. She was forbidden to work as a cook. However, Mary refused to believe that she could be carrying such a serious illness, for the simple reason that she herself was not sick. Mary Mallon never got typhoid fever—although she definitely carried it and passed it on to more than 40 other people, three of whom died.

We have learned a lot, since that time, about how it is possible for a person to carry, and even transmit, infectious microorganisms without being sick. Many people, for example, carry *Staphylococcus* bacteria on their skin or inside their nose. Unless they show symptoms of illness, these people are not said to be “infected.” Instead, they are said to be “colonized.” They carry the bacteria, and they can give it to others, but they are not themselves sick.

Whether bacteria infects a person or simply colonizes that person has to do with a lot of factors that can change even within the same individual. For example, people who take certain steroids, which can suppress the immune system, may become more vulnerable to infection while they are taking those drugs. People who suffer a cut or wound may find that it becomes infected because bacteria that normally live harmlessly on their own skin get into the wound, where they flourish and overcome the body’s defenses.

One way that some hospitals are trying to cut down on the number of drug-resistant infections, such as methicillin-resistant *Staphylococcus aureus* (MRSA), is by identifying individuals who enter the health care environment who are not just infected, but also “colonized,” with these bacteria. It is believed that individuals who are colonized with MRSA are the most common source of transmission of the disease. Special precautions can be taken to avoid carrying the bacteria from the colonized individual to people who would be more likely to become infected with it, i.e., those with suppressed immune systems or open wounds.

One of the reasons Typhoid Mary continued to infect people with typhoid was poor hygiene. *Salmonella typhi*, which causes typhoid fever, is carried in the feces. Thorough handwashing might have made it safe for Mary to continue in her occupation of cook. Good hand hygiene is no less important for health care workers today than it was for Mary Mallon then. An outbreak of SARS in a Toronto hospital in 2003 was found to be partly attributable to workers who carried the virus from infected patients to uninfected patients—and to themselves. Two nurses and a doctor died as a result of the outbreak.
For more information on handwashing that could help prevent disease transmission, see Section 4.21, Hand Hygiene.

4.12 What Makes a Disease “Infectious”? 

Not all diseases are “infectious.” Diabetes, high blood pressure, heart disease, Down’s syndrome, cerebral palsy... these diseases have genetic, traumatic, or lifestyle causes, and they’re not “catching.” You can live in the same home, breathe the same air, even perform medical procedures for someone with any of these diseases, and you need not worry about getting the disease from them.

Methods of Transmission

Infectious diseases spread from person to person, or rather the disease-causing organism spreads from one individual to another, by one or more of these methods:

- **Contact with infected blood, tissues, or bodily fluids:** Diseases that spread in this way include HIV, hepatitis B, and hepatitis C. Infection control procedures for these diseases are covered under the Bloodborne Pathogens Standard.

- **Droplet transmission:** Some disease-causing organisms (bacteria and viruses) are found in the fluids of the upper respiratory tract (saliva, nasal secretions, phlegm) and enter the air in small particles of liquid droplets when an infected person speaks, spits, coughs, or sneezes. Droplets are large and heavy, typically traveling no more than three feet away from a person who sneezes or coughs. Other individuals who are nearby may breathe the infected droplets, enabling the virus or bacteria to enter the body through that person’s mouth, nose, and lungs. Diseases that spread in this way include tuberculosis, measles, chicken pox, bacterial meningitis, pertussis (whooping cough), colds, and influenza.

- **Airborne transmission:** Where droplets tend to be infectious only in close proximity to infected patients, some disease-causing organisms can form a smaller, lighter particle called an “aerosol.” These aerosols can be carried long distances through the air, including through ventilation systems. Airborne transmission is believed to play a significant role in the spread of diseases on cruise ships, airplanes, and similar environments that have enclosed ventilation systems. It can also be a significant method of transmission in health care settings where infectious individuals and susceptible individuals are in close contact. Diseases that spread in this way include tuberculosis and possibly influenza.
• **Contact transmission:** Some disease-causing organisms can be transmitted by direct contact with an infected person or indirectly by contact with an object (e.g., bedding, clothing, medical equipment, doorknobs, silverware, or furnishings) that the person has touched. Objects that carry diseases from one person to another are called **fomites.** Diseases that spread in this way include Staphylococcal and Streptococcal infections and colds.

4.13 **Bacteria or Virus?**

Infectious diseases are generally classified by whether they are caused by bacteria or viruses.

**Bacteria**

Some infectious diseases are caused by microscopic living organisms called “bacteria.”

Common bacterial agents include:

**Staphylococcus aureus (S. aureus or “staph”):**

- Staph is normally present on the skin or inside the nose of healthy people. Approximately 25% to 30% of Americans have staph present inside the nose at any given time.
- Staph is one of the most common causes of minor skin infections such as pimples and boils. It also causes bone infections, pneumonia, severe, life-threatening bloodstream infections (septicemia), and other diseases.
- According to a study published by the Centers for Disease Control and Prevention (CDC) in 2010, rates of invasive, life-threatening methicillin-resistant S. aureus (MRSA) infections are declining. Invasive MRSA infections that began in hospitals declined 28% from 2005 through 2008. Another report from the National Healthcare Safety Network found that rates of MRSA bloodstream infections occurring in hospitalized patients fell nearly 50% from 1997 to 2007. So, infection control efforts are having an important effect on these infections.
- Two vancomycin-resistant strains of resistant **S. aureus** have been identified; they are called vancomycin-intermediate and vancomycin-resistant **S. aureus** (VISA and VRSA). In the United States as of October of 2010, 11 cases of VRSA have been identified in four states. All of these infections occurred in patients with several underlying health problems (for example, diabetes and kidney disease), a history of infection with MRSA, tubes entering their bodies, recent hospitalization, and recent exposure to vancomycin.
• Staph spreads by direct physical contact with an infected person or contact with a contaminated object such as a towel used by an infected person.
• Diseases caused by staph are treated with antibiotics. There are effective antibiotics even for drug-resistant varieties. No vaccine is available.

**Group A Streptococcus (GAS or “strep”):**

• GAS is commonly found in the throat and on the skin, but it does not normally cause infection.
• GAS is not the same bacterium as Group B Streptococcus (GBS), which is the most common cause of life-threatening infection in newborns. Nor is it the same as *Streptococcus pneumoniae*, which is one of the most common causes of childhood ear infections.
• GAS causes minor illnesses such as strep throat and impetigo, which is a skin infection. If it invades the body, it also can cause major illnesses such as necrotizing fasciitis, which destroys muscles, fat, and skin tissue (often described as “flesh-eating bacteria”), and streptococcal toxic shock syndrome, which causes a rapid drop in blood pressure and organ failure. (Note: The latter is not the same disease as the toxic shock syndrome that is associated with tampon use).
• GAS spreads by direct contact with mucus from the nose or throat of persons who are sick or by contact with infected skin wounds or sores. The CDC no longer believes that this bacteria is likely spread by contact with toys, dishes, or other household objects used by infected persons.
• There are several million cases of strep throat and impetigo each year in the U.S. and 9,000 to 11,500 cases of invasive disease caused by GAS. Invasive GAS causes about 1,000 to 1,800 deaths annually.
• Diseases caused by GAS are treated with antibiotics. There are effective antibiotics even for drug-resistant varieties. No vaccine is available for GAS. The pneumococcal-conjugate vaccine is effective against *Streptococcus pneumoniae*.

**Mycobacterium tuberculosis (TB):**

• This bacteria causes tuberculosis (TB), which can attack any part of the body but usually attacks the lungs.
• TB spreads by droplet transmission and airborne transmission.
• Almost 11,550 cases of TB were reported in the United States in 2009.
• TB is treated with antibiotics. Some strains are resistant to multiple drugs. A strain of TB that is resistant to almost every drug used to treat TB, called extensively drug-resistant or “XDR” TB, has recently been identified. A vaccine is available, but it is
not often used. The vaccine is not always effective at preventing the disease, and it can cause vaccinated persons to have a false-positive reaction to a TB skin test, making it more difficult to monitor health care workers for the disease.

**Clostridium difficile (C. difficile)**

- *C. difficile* is a bacterium that causes diarrhea and more serious intestinal illnesses, including colitis. The incidence and severity of *C. difficile* infection has been increasing since the 1980s.
- *C. difficile* is transmitted by direct contact. Workers or others who are caring for individuals with *C. difficile* disease become contaminated with the bacteria through contact with feces or feces-contaminated items, and can then transfer the infection to themselves or to others.
- Healthy individuals may become colonized with *C. difficile*, but not become ill right away. Colonized individuals may develop active illness when they take a course of antibiotics or acquire another illness.
- As of 2008 (the latest data available), twelve cases of occupationally-acquired *C. difficile* illness had been reported in health care workers.
- Alcohol-based hand sanitizers are ineffective against *C. difficile*, so workers who have contact with feces or with patients who are suffering from diarrhea should wash with soap and water following contact with patients or with objects in their room. In addition, furnishings and equipment in the rooms of patients infected with *C. difficile* should be disinfected with bleach.

**Viruses**

Other infectious diseases are caused by “viruses.” Viruses are organisms that consist of a strand of genetic material and an external membrane. They can only reproduce inside a living cell. The principal defense against viruses is vaccination to prevent the disease, coupled with infection control practices that prevent the disease from spreading to uninfected individuals. Viruses are not treated with antibiotics but with a different class of antimicrobial drugs called “antivirals.” Viral diseases that health care workers need to be aware of include:

- **Influenza (“Flu”):** There are many different strains of flu virus. The disease can be transferred from animals to humans. It changes and mutates from year to year. A new vaccine is designed annually to protect humans against the flu.
- **Hepatitis:** There are many different strains of hepatitis virus; all of them attack the liver. The most common strains in the United States are the hepatitis B virus (HBV) and hepatitis C virus (HCV). A vaccine is available to prevent HBV, as well as the less-common hepatitis A virus (HAV), but no vaccine is currently available for HCV.
• **HIV/AIDS**: Acquired Immune Deficiency Syndrome (AIDS) is caused by the Human Immunodeficiency Virus (HIV). HIV attacks the immune system. No vaccine is available for HIV/AIDS.

### 4.14 General Infection Control Strategies

Health care facilities and health care workers need to take precautions to prevent the spread of infection. The type of precautions used will vary depending upon the environment (hospital, nursing home, public clinic, home health care, etc.) and the disease. Engineering controls, work practice controls, and the use of personal protective equipment are three approaches to preventing the spread of infectious diseases in a health care facility. Some of the more important controls of each type are discussed in detail in this section. In the next few sections, you'll see how they fit into standard infection control precautions and the additional precautions required for certain types of diseases.

#### Engineering Controls

Engineering controls include the following:

- **Negative Pressure Ventilation**: For diseases that may spread through the air, isolation rooms with monitored negative air pressure and 6 – 10 room-air-changes per hour may be used. These rooms are called “airborne infection isolation” rooms. The ventilation systems in these rooms require maintenance and disinfection. Personnel who do this work will have to wear personal protective equipment and be trained in how to safely disinfect the ventilation system.

- **Ultraviolet Light**: Ultraviolet (UV) light is deadly to many pathogens, which is one reason that some pathogens don’t survive well outside the body. Many hospitals and health care facilities have installed UV light sources in public areas, entryways, and patient wards in order to destroy pathogens.

#### Work Practice Controls

Work practice controls include the following:

- **Patient Screening**: Hospitals in Europe, Veteran’s Administration hospitals, and other hospitals in the U.S. are swabbing the nasal passages of arriving patients to test for resistant bacteria. Patients found to be colonized with resistant strains of *S. aureus* are kept isolated in rooms with dedicated equipment that is disinfected after each use for the
duration of their stay. Some health care facilities have drastically reduced the incidence of drug-resistant infections by using this technique. In several states, legislation has been passed that requires the screening of high-risk patients.

- **Handwashing:** Thorough handwashing before and after patient contact is one of the most effective ways to prevent the spread of disease to health care personnel and to other patients. In addition, health care providers should avoid touching their own faces because a common means of infection is touching a contaminated object (doorknob, toilet seat, bedrail) and then touching their eyes, ears, mouth, or nose. Hand hygiene is discussed in more detail in Section 4.21.

- **Dedicated Patient Equipment:** For virulent infectious diseases, some patient care equipment such as stethoscopes, blood pressure cuffs, and thermometers should be dedicated for use with only one patient. Some facilities go so far as to sterilize all such equipment after use. In this way, infections will not be spread from the patient to others via contaminated medical equipment.

- **Avoid Contact:** Do not touch your own skin, nose, eyes, or mouth with contaminated hands—whether or not you are wearing gloves. Also, do not touch any surface or object that is not directly related to patient care, such as doorknobs and light switches, with contaminated hands.

- **Respiratory Hygiene and Cough Etiquette:** Health care workers should practice and promote respiratory hygiene and cough etiquette. Anyone who shows signs of a respiratory infection should cover their nose and mouth when coughing or sneezing, preferably with a disposable tissue, and wash their hands afterward. Respiratory hygiene and cough etiquette is discussed in more detail in Section 4.22.

- **Droplet and Airborne Precautions:** When a patient has a respiratory illness, including tuberculosis or influenza, health care workers should wear masks when entering the patient's room. Patients should be kept in isolation, and social visits should be restricted. In addition, health care workers performing high-hazard procedures such as suctioning should wear full protective gear. Droplet precautions are discussed in more detail in Section 4.18. See Section 4.19 for more information on airborne precautions.

- **Environmental Cleaning and Disinfection:** Frequently touched surfaces in health care settings, such as phones, bed rails, and bathroom fixtures, should receive special emphasis and attention when cleaning and disinfecting. Cleaning and disinfection are discussed in more detail in Section 4.20.

**Personal Protective Equipment**

Personal protective equipment that may be required includes the following:
• **Gloves:** Most health care workers normally wear gloves while engaging in patient contact and housekeeping duties. Gloves must be worn for any activity that might involve blood, body fluids, secretions, or excretions coming into contact with the worker’s clothing or exposed skin.

• **Gowns:** Health care workers must wear gowns for procedures or activities that may result in blood, body fluids, secretions, or excretions coming into contact with the worker’s clothing or exposed skin. Gowns should be removed before the worker leaves the patient’s environment. Gowns should not be reused, even if the worker returns to care for the same patient.

• **Face and eye protection:** Health care workers must wear face and eye protection, such as masks, goggles, and face shields, for activities that are likely to splash or spray blood or other body fluids and secretions.

• **Respirators:** For some diseases, like multiple drug-resistant TB, health care workers may be required to wear respirators during patient contact.

### 4.15 Standard Precautions

"Standard precautions" for infection control developed out of both “universal precautions,” which were originally designed to protect health care workers against bloodborne pathogens, and the principles of body substance isolation. The underlying assumption of standard precautions is that all blood, body fluids, secretions, excretions (except sweat), non-intact skin, and mucous membranes may transmit disease from an infected individual to an uninfected one. Like universal precautions, standard precautions apply to all patients in the health care environment, since the health care provider is unlikely to know the full health status of every patient at all times. Unlike universal precautions, standard precautions are intended to protect both the health care worker and the patient against infectious diseases.

Standard precautions help health care workers to determine appropriate measures based on the anticipated exposure both from direct patient contact and from handling contaminated equipment or items in the patient environment. In addition to personal protective equipment (PPE) selection (gloves, gown, mask, eye protection, face shield, etc.), standard precautions include safe injection practices, which are covered in Section 4.16.

**Principles of Standard Precautions**

In order to follow standard precautions, you should understand and use the following principles:
• Assume that every person is potentially infected or colonized with infectious microorganisms, and take appropriate precautions.
• Avoid touching surfaces near the patient while delivering care, both to avoid contaminating your own hands and the surfaces themselves.
• Wash your hands with soap and water whenever they are visibly soiled.
• Decontaminate your hands as recommended in Section 4.21, Hand Hygiene.
• Select and wear PPE based on the tasks you will be performing (see Section 4.14, General Infection Control Strategies).
• Educate patients in respiratory hygiene and cough etiquette, as needed (see Section 4.22, Respiratory Hygiene and Cough Etiquette).
• Isolate patients with communicable diseases whenever possible. Or, place patients with the same communicable condition together in a single area.
• Establish safe work practices for the handling and transport of contaminated patient-care equipment and instruments.
• Establish safe work practices for care of the environment.
• Establish safe work practices for handling laundry.

4.16 Safe Injection Practices

Injecting a patient is a critical hazard-control point for health care workers and patients alike, so standard precautions include safe injection practices when necessary. These recommendations from the Centers for Disease Control and Prevention, which can be found in the Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007, apply to the use of needles, cannulas that replace needles, and, where applicable, intravenous delivery systems. The CDC recommendations include the following:

• Use the aseptic technique to prevent contamination of sterile injection equipment.
• Single-use items include needles, cannulas syringes, and fluid infusion and administration sets. Never administer medications to multiple patients from a single syringe, even if the needle or cannula on the syringe is changed. Never reuse needles, cannulas, or syringes for another patient, nor to access a medication or solution that might be used for a subsequent patient. Also, consider a syringe, needle, or cannula to be contaminated once it has been used to enter or connect to a patient’s intravenous infusion bag or administration set. Use fluid infusion and administration sets (i.e., intravenous bags, tubing, and connectors) for one patient only and then dispose of the set properly after use.
• Administer parenteral medications from single-dose vials whenever possible.
• Never use single-dose vials or ampules to administer medications to multiple patients.
• Never combine leftover contents for later use.
• Access multi-dose vials only with sterile needles, cannulas, and syringes.
• Store multi-dose vials in accordance with manufacturer's directions. Do not keep them in the immediate patient treatment area. Discard any vials whose sterility is compromised or questionable.
• Never use bags or bottles of intravenous solution as a common source of supply for multiple patients.
• Wear surgical masks when performing or assisting in special lumbar puncture procedures that involve placing a catheter or injecting material into the spinal canal or subdural space (i.e., during myelograms, lumbar puncture, and spinal or epidural anesthesia).
• Observe bloodborne pathogens exposure control precautions (i.e., "universal precautions") when performing injections.

4.17 Contact Precautions

Contact precautions may not prevent the transmission of all infectious diseases. In some cases, health care workers may have to take additional precautions against diseases transmitted by direct contact, droplets, or aerosols.

Contact precautions are intended to prevent transmission of infectious agents that are spread by direct or indirect contact with the patient or the patient's environment. Contact precautions should also be used when patients have excessive wound drainage, fecal incontinence, or other discharges from the body that could increase the possibility of extensive environmental contamination.

Contact precautions include the following:

• Isolation: Place infected patients in private rooms or in groups of rooms that house only patients with the same disease. In an acute-care setting, place patients requiring contact precautions in a private cubicle or examination room as soon as possible.
• Personal Protective Equipment (PPE): When taking contact precautions, put on gloves and a gown upon entry to the patient care room. Wear gloves whenever touching the patient's intact skin or surfaces and objects close to the patient. Remove gloves and gowns before leaving the room and dispose of them properly.
• Hand Hygiene: After removing gowns and gloves, wash and dry your hands, and then take care not to come into contact with any potentially contaminated environmental surfaces.
• **Patient Transport:** Allow patients to move around as little as possible. When it’s necessary to move a patient, remove contaminated PPE and wash your hands before leaving the patient care area. Put on fresh PPE when you arrive at your destination. During transport, keep covered any colonized or contaminated areas of the patient’s body.

• **Patient Care Equipment:** Use dedicated or single-use disposable equipment to care for patients under contact precautions. Leave the equipment in the immediate patient care environment (the patient’s room or home, for example) until the patient is discharged, if possible. If contaminated equipment must be removed from the area, seal it in plastic bags first.

• **Care of Environment:** For patients under contact precautions, disinfect the environment often, particularly items like bedrails and doorknobs that are frequently touched.

### 4.18 Droplet Precautions

To prevent the spread of diseases that are spread through inhalation or mucous membrane contact with an infected individual’s respiratory secretions, such as SARS, the Centers for Disease Control and Prevention (CDC) recommends that health care facilities and health care workers use the following droplet precautions in addition to standard precautions:

• **Isolation:** Place infected patients in private rooms or in groups of rooms that house only patients with the same disease. Assign employees to work with the same group of patients, rather than rotate them from an infected group to an uninfected group of patients.

• **Respiratory Hygiene and Cough Etiquette:** Explicitly instruct patients in respiratory hygiene and cough etiquette (see Section 4.22).

• **Respiratory Protection:** Put on a mask when entering the rooms of patients under droplet precautions. For patients with suspected or proven SARS, avian influenza, or pandemic influenza, the CDC recommends that workers and employers obtain the most current recommendations (see [http://www.cdc.gov/nciddod/sars](http://www.cdc.gov/nciddod/sars), [http://www.cdc.gov/flu/avian](http://www.cdc.gov/flu/avian), or [http://www.pandemicflu.gov](http://www.pandemicflu.gov), as applicable).

• **Restricted Movement:** Instruct infected patients to remain in their rooms as much as possible. They should leave their rooms only when it is medically necessary and should wear a mask when they do so.

• **Other Protective Equipment:** The CDC does not recommend routine use of eye protection as part of droplet precautions. Wear other protective equipment (gowns, gloves, eye protection, etc.) as appropriate, utilizing standard precautions.
4.19 Airborne Precautions

To prevent the spread of diseases that can be infectious over long distances when suspended in the air (such as measles, chickenpox, *M. tuberculosis*, and possibly SARS-CoV), the Centers for Disease Control and Prevention recommends that health care facilities and health care workers use the following airborne precautions in addition to standard precautions:

- **Isolation:** Whenever possible, place infected patients in an airborne infection isolation room (AIIR), which is a single-patient room equipped with special air handling and ventilation. Place patients with the same disease in the same part of the facility. In an ambulatory care setting, use triage procedures to identify patients with potential airborne infectious diseases. If these patients cannot be placed in an AIIR, mask the patients, place them in a private exam room, and instruct them to observe respiratory hygiene and cough etiquette procedures. Once the have been removed from the room, leave the room vacant for an hour in order to allow the air to be completely exchanged.

- **Immune Caregivers:** Whenever possible, ensure that the caregivers assigned to patients with known or suspected measles, chickenpox, disseminated herpes zoster, or smallpox are immune to those illnesses, either through vaccination or disease history. Do not assign personnel who are not immune to those diseases to care for those patients when alternatives are available.

- **Respiratory Protection:** Personnel who are immune to the disease carried by the person they are treating (for example, measles or chickenpox) do not need to wear respiratory protection while treating these patients. Personnel who are treating patients with infectious pulmonary or laryngeal tuberculosis, infectious tuberculosis skin lesions (if procedures are to be performed that could create airborne disease particles, like irrigation), or smallpox should put on a fit-tested, NIOSH-approved N95 or higher level respirator for respiratory protection before entering the room. Even vaccinated personnel should wear respiratory protection when potentially exposed to smallpox, since the vaccine may not protect against genetically altered forms of the virus or against highly concentrated exposures.

4.20 Cleaning, Disinfection, and Sterilization

Cleaning, disinfection, and sterilization are all important methods for minimizing infectious organisms in the health care work environment and on medical equipment. Patient rooms, examination rooms, reusable medical equipment, furnishings, floors, fixtures, bathrooms, linens, towels, and clothing must be decontaminated after they have been exposed to potentially infectious agents.
In infection control, the three words “cleaning,” “disinfection,” and “sterilization” have specific meanings. For example, something that must be sterilized is treated far differently from something that must only be disinfected. It is important to understand the distinctions as well as when and how to use each method, as follows:

- **Cleaning** is the process of removing visible contamination from an object. Cleaning is not the same as disinfection since infectious microorganisms may remain on an object that looks clean. However, in order for disinfection or sterilization to be effective, equipment and objects must first be cleaned.

- **Disinfection** is a process that destroys almost all infectious organisms on inanimate objects. However, some infectious agents will form spores, which are difficult to destroy. Disinfection will not destroy all spores. There are three levels of disinfection. Typically, each one uses a different chemical disinfectant, as follows:
  - **High-level disinfection** kills all organisms except high concentrations of bacterial spores. High-level disinfection is used for reusable medical instruments that come into contact with mucous membranes, such as endoscopes and anesthesia breathing circuits, and reusable medical instruments that are not heat-stable, such as laparoscopic telescopes.
  - **Intermediate-level disinfection** kills most viruses and bacteria including mycobacteria such as *M. tuberculosis*, which causes tuberculosis.
  - **Low-level disinfection** kills some viruses and bacteria and must be done with a chemical registered with the Environmental Protection Agency as a hospital disinfectant.

- **Sterilization** is used for medical equipment that enters a patient’s normally sterile tissue or blood vessels or through which blood and other body fluids flow. Sterilization destroys all potentially infectious organisms including highly resistant bacterial spores. Common methods of sterilization include moist heat (steam autoclaving), dry heat, and ethylene oxide (chemical) sterilization. Other chemical methods are used for medical equipment that is sensitive to heat.

**Selecting a Method to Deal with Infectious Pathogens**

When you know what kind of infectious pathogen you’re dealing with, make sure you also know what precautions to take. For example, when dealing with a patient who has a highly infectious, drug-resistant or easily communicable pathogen like methicillin-resistant *S. aureus* (MRSA) or severe acute respiratory syndrome (SARS), normal cleaning and disinfection protocols will not apply. Instead of simply cleaning or performing low-level disinfection of floors, tabletops, door handles, and equipment in a patient’s room with MRSA, intermediate- or high-level disinfection, or even disposal, of some of these items may be required. On the other hand, if you don’t know what kind of
pathogen you are dealing with (for example, in a walk-in clinic where a patient with undiagnosed tuberculosis or other infectious disease might be present), paying careful attention to routine cleaning and disinfection practices can help to prevent the spread of that disease.

**Cleaning and Disinfecting Electronic Medical Equipment**

Some medical equipment can be sterilized in an autoclave or sterilant bath. Environmental surfaces are often disinfected with surface treatments. However, there is a third class of items that are difficult to disinfect or sterilize, and improper disinfection of these items has caused problems. As a result, four government agencies (the Food and Drug Administration, Centers for Disease Control and Prevention, Environmental Protection Agency, and OSHA) issued a Public Health Notification on October 31, 2007, “Avoiding Hazards with Using Cleaners and Disinfectants on Electronic Medical Equipment,” available at http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/PublicHealthNotifications/ucm062052.htm.

Electronic medical equipment, including infusion pumps, ventilators, patient-controlled analgesia pumps, sequential compression device pumps, telemetry physiological signal receivers and transmitters, infusion fluid warmers, infant anti-abduction sensors, and any other patient-care equipment that has unsealed electronic circuitry or components (including computer workstations, handheld devices and other monitoring equipment), sometimes becomes contaminated with blood or other potentially infectious materials. Such equipment is also sometimes used in isolation units. Some health care organizations have attempted to clean, disinfect, and decontaminate this equipment by spraying it with disinfectant or wrapping it with disinfectant-soaked towels.

However, when the disinfectant penetrates the housing, it causes corrosion of the machines’ electronic circuitry. This has caused malfunctions, including equipment fires, and burns to health care workers. From a patient-care perspective, there is concern that this damage could cause over-infusion of patient medications, failure of ventilation, or loss of life-supporting drug therapy. Therefore, whenever cleaning or disinfecting electronic medical equipment, be careful to observe the manufacturer’s recommendations, so that the electronic components are not damaged.

According to the Public Health Notification cited above, you should do the following when cleaning and disinfecting electronic medical equipment:

- Identify affected equipment, which can be done by checking the equipment label for any precautions about wetting, immersing, or soaking the equipment.
• Protect affected equipment against contamination whenever possible by:
  - being careful not to touch the equipment with contaminated hands or gloves
during patient care,
  - positioning the equipment so that it is protected from anticipated spatter,
  - taking care not to place contaminated items on unprotected equipment surfaces,
  - using barriers on equipment surfaces when there is a high likelihood that the surfaces
will come into contact with spatter, contaminated gloves, or other contaminated
items.
• Do the following if equipment is believed to be contaminated with pathogens requiring
contact precautions (i.e., those pathogens that can be transmitted by direct contact with
contaminated objects):
  - Clean the equipment surfaces, following the recommendations of both the equipment
  manufacturer and the chemical manufacturer.
  - If the equipment must be disinfected, contact the equipment manufacturer to
discuss strategies that would avoid wetting the equipment.
• Always follow the chemical manufacturer’s directions for use. All federal regulations,
recommendations, and guidelines support the position that the manufacturer’s direc-
tions for use are the primary source for information on how to apply disinfectants and
the time required to achieve disinfection. Manufacturers of both regulated medical
equipment and disinfectants are required by law to provide adequate directions for
use of their products. In fact, it is a violation of the Federal Insecticide, Fungicide,
and Rodenticide Act to use disinfectant chemicals in a manner inconsistent with their
labeling; in addition, disinfectants that are improperly used may not disinfect the
equipment they are applied to.
• Equipment that is contaminated with blood or other potentially infectious material must
be decontaminated according to the requirements of OSHA’s Bloodborne Pathogens
Standard (see the training module on “Bloodborne Pathogens” for more information).
The equipment must first be cleaned according to the manufacturer’s directions to remove
as much soil as possible. The equipment must then be removed from service for thorough
cleaning and disinfection, if necessary.

4.21 Hand Hygiene

Since the 19th century, health care personnel have been advised to wash their hands before
attending to patients. This is largely a patient-protection measure since health care personnel
working directly with patients can transfer infections on their hands from one patient to
another. However, hand hygiene is also a worker health issue.
Everyone carries living organisms on their skin; bacteria and yeasts are the most common. Some of these bacteria are “transient,” which means that they are present only on the surface layers of the skin and can be readily washed off or killed using hand sanitizers. Other organisms are “resident” in that they have penetrated into deeper layers of skin and are much harder to remove. Good hand hygiene can keep pathogenic organisms, like drug-resistant *S. aureus* and yeasts, from becoming resident on a health care worker’s hands, which could cause problems should the employee have an invasive medical procedure or an immuno-compromised system.

A health care worker’s hands, like any other instrument or device used in patient care, may need to be cleaned, decontaminated, or both. The recommendations described here are taken from the Centers for Disease Control and Prevention’s *Guideline for Hand Hygiene in Health-Care Settings* (October 25, 2002).

**Proper Hand Cleaning Technique**

**To clean your hands, wash them with plain (not antimicrobial) soap and water.** First, wet your hands with cool water (using hot water increases the chance of skin irritation). Then, apply soap, making sure you use enough (the recommended amount should be on the label), and rub your hands together vigorously for at least 15 seconds. Make sure to rub all surfaces of your hands and fingers. Rinse with water, and dry your hands thoroughly with a disposable towel. Drying thoroughly is important because if your hands are damp, they will pick up and carry more microbes from anything you touch than if they were dry. Use the disposable towel to turn off the faucet.

You should **clean** your hands:

- **whenever** they are visibly soiled;
- **before** eating; and
- **after** using a restroom.

**Proper Hand Decontamination Technique**

**To decontaminate your hands, wash them (as described above) with an antimicrobial soap or use an alcohol-based hand sanitizer.** To decontaminate your hands with a sanitizing rub, apply the product to the palm of one hand, using as much as the manufacturer recommends (it should say on the label), and rub your hands together. Make sure to cover all surfaces of the fingers and hands, and continue rubbing until your hands are dry.
You should decontaminate your hands:

- **before** having direct contact with patients;
- **before** putting on sterile gloves when inserting a central intravascular catheter;
- **before** inserting indwelling urinary catheters, peripheral vascular catheters, or other invasive devices that do not require a surgical procedure;
- **after** contact with a patient’s intact skin;
- **after** contact with bodily fluids or excretions, mucous membranes, non-intact skin, and wound dressings (Note: If your hands are visibly soiled, clean them first and then decontaminate.);
- **whenever** you are moving your hands 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; and
- **after** removing gloves.

**Additional Hand Hygiene Considerations**

Some additional hand hygiene considerations include the following:

- **Antimicrobial Hand Wipes:** Antimicrobial hand wipes can be used for cleaning hands in low-risk health care settings. However, they are less effective than antimicrobial soap and alcohol-based hand rubs, so they should not be used routinely or in high-risk situations.

- **Gloves:** Even if you wear gloves for patient contact, you must perform hand-hygiene procedures. Used together, good hand-hygiene practices and gloves substantially reduce the risk of cross-contamination and the spread of infection between patients and from patients to health care personnel. You should change gloves after each contact with a patient and after contact with the environment (including medical equipment) surrounding a particular patient, using proper technique to prevent hand contamination. Do not wear the same pair of gloves to care for more than one patient. Even if the gloves have been washed before reuse, this practice is associated with disease transmission. You should also change gloves while caring for a single patient if you move from a contaminated area to a clean part of the body.

- **Fingernails:** Even after scrubbing for a surgical procedure (which is much more thorough than the procedures described above), health care personnel harbor microbes underneath their fingernails. Minimize the microbe count on your hands by not wearing artificial fingernails. In addition, if you work with high-risk patients, keep your real fingernails trimmed to not more than one quarter of an inch.
• **Skin Care:** Frequent hand washing and sanitizing dries out the skin. The employer should provide hand lotions or creams. They should be water-based, as oil-based lotions can break down protective gloves, and formulated so as not to interfere with the actions of the soaps and sanitizers used in the workplace.

• **Obstacles to Good Hand Hygiene:** If you find yourself not washing and sanitizing your hands when you should, ask yourself why, and bring the problem to your employer’s attention. Are paper towel holders not being filled often enough? Does the available hand sanitizer have an offensive odor? Is your facility understaffed, leaving you less time with patients and between patients for proper hand hygiene? Some problems are easier to solve than others, but hand hygiene is important enough that an attempt to solve them should be made.

• **Fire Safety:** Alcohol-based hand rubs are not considered a fire hazard in health care settings. Fire codes generally forbid their installation in exit corridors, but installation in patient rooms is generally permitted.

### 4.22 Respiratory Hygiene and Cough Etiquette

It is good to be a giving person—unless what you are giving is a respiratory infection! The Centers for Disease Control and Prevention recommend that everyone who has symptoms of a respiratory illness, regardless of the presumed cause, should refrain from spreading their illness to others by:

• covering their mouth and nose when coughing or sneezing;
• using a disposable tissue to contain respiratory secretions;
• disposing of tissues promptly after use; and
• washing their hands, or using an alcohol-based hand sanitizer, after every contact with respiratory secretions or contaminated objects or surfaces.

To make respiratory hygiene easier, health care facilities should ensure that tissues, trash cans, and hand-rub dispensers are readily available and that sinks are always stocked with soap and paper towels.

**Masks**

During flu season, anyone in a health care facility who has symptoms of respiratory infection should be offered a mask—either a surgical or procedure mask is acceptable. Persons who are coughing should be encouraged to sit at least three feet away from others in waiting rooms. Some health care facilities may choose to make this a year-round policy.
Along with hand hygiene (see Section 4.21), immunization is one of the most effective ways of preventing disease transmission. Immunizations or vaccinations activate your body’s immune system so that it recognizes and destroys an infectious organism before it has a chance to make you sick. Immunizations are not available for all diseases, and they are not recommended for everyone. **If you have workplace exposure to an infectious disease for which a vaccine is available, ask your employer about being immunized.**

**Recommended Vaccines**

The Centers for Disease Control and Prevention’s Advisory Committee on Immunization Practices strongly recommends that health care personnel receive certain vaccines for common infectious diseases. The **recommended vaccines** include the following:

- **BCG:** A vaccine known as “BCG” prevents tuberculosis infection and is recommended for health care workers in areas where multiple-drug resistant TB is prevalent and a strong likelihood of infection exists.
- **Hepatitis A:** This vaccine is recommended for individuals who work with hepatitis A-infected primates or with the hepatitis A virus in a laboratory setting.
- **Hepatitis B:** This vaccine is recommended for health care personnel who may be exposed to blood and other bodily fluids.
- **Influenza:** Flu shots are recommended for health care personnel who either work with high-risk patient populations or who themselves belong to a high-risk population. A new flu vaccine is available annually.
- **Measles, Mumps, Rubella (MMR):** Most health care personnel should receive one or more of these vaccines if they have no proof of existing immunity (i.e., vaccination records).
- **Meningococcus:** Although this vaccine is not routinely recommended in the U.S., it may be important for health care personnel to be vaccinated if there is an outbreak of meningococcal disease.
- **Polio, inactivated (IPV II) or oral (OPV):** This vaccine is recommended for health care personnel and laboratory workers who may be exposed to wild poliovirus.
- **Rabies:** This vaccine is recommended for laboratory personnel who work with the rabies virus or with rabies-infected animals.
- **Tetanus/Diphtheria:** This vaccine is recommended for all adults.
- **Typhoid, inactivated (Vi) or oral (Ty21a):** This vaccine is recommended for laboratory personnel who work with *Salmonella typhi.*
• **Varicella:** This vaccine against chicken pox is recommended for health care workers if they have no proof of current immunity either by showing a history of having had chicken pox or by serologic tests.

• **Vaccinia:** This smallpox vaccine is recommended for workers who handle cultures of, or animals contaminated with, recombinant smallpox virus or related animal viruses (monkeypox, cowpox, etc.).

**When Vaccinations Are NOT Recommended**

Some individuals should not be vaccinated because of existing health conditions. Health conditions that might prevent you from receiving a particular vaccine include:

• **Pregnancy:** Women should not receive the MMR (measles/mumps/rubella) vaccine or the varicella (chickenpox) vaccine while they are pregnant.

• **HIV Infection:** Individuals who are HIV positive should not receive:
  - the BCG vaccine (which protects against tuberculosis),
  - OPV (oral polio vaccine),
  - Ty21a (a vaccine for typhoid),
  - varicella (chicken pox), or
  - vaccinia (smallpox).

• **Severe Immuno-Suppression:** Individuals with severe immuno-suppression should not receive:
  - the BCG vaccine (which protects against tuberculosis),
  - MMR (measles/mumps/rubella) vaccine,
  - OPV (oral polio vaccine),
  - Ty21a (a vaccine for typhoid),
  - varicella (chicken pox), or
  - vaccinia (smallpox).

**When Vaccinations Are Allowed Despite Health Conditions**

Individuals with any of the following diseases may be allowed to receive the recommended vaccinations, but they should consult with their doctors before doing so:

• **Asplenia:** Individuals who have no spleen can receive any of the recommended vaccinations that are appropriate for their job duties.

• **Renal Failure:** Individuals with renal failure can receive any of the recommended vaccinations that are appropriate for their job duties.
• **Diabetes**: Individuals with diabetes can receive any of the recommended vaccinations that are appropriate for their job duties.

• **Alcoholism and Alcoholic Cirrhosis**: Individuals with alcoholism and alcoholic cirrhosis can receive any of the recommended vaccinations that are appropriate for their job duties.

### 4.24 Working Safely

In an outbreak of infectious disease, health care workers are at risk of becoming victims exactly at the time and place they are needed most. The generally applicable practices of infection control will help to protect you, not only from the threats you’re aware of, but from those that haven’t yet been identified. So make a habit of:

• performing routine, low-level disinfection in any area where infection **might** exist;
• performing higher-level disinfection in any area where infection is **known** to exist; and
• wearing gloves and using hand hygiene practices.

Your diligence will pay off, both now and on the day you’re able to keep caring for patients who need your skills—the day you didn’t become a victim because you always wash your hands.