



Dodging the Bugs: Infection Control at Work

Coping with infectious disease in the workplace (healthcare and non-healthcare) has become a common challenge in recent years. To manage this risk and the risk communication challenges associated with it, supervisors and managers need basic information on the principles of infectious disease transmission for a variety of reasons:

- To prevent infectious disease transmission in the workplace
- To help recognize when professional infection control assistance is needed
- To assist their risk communication efforts when media focus has resulted in hysteria or concern in the absence of risk
- To provide a foundational understanding of infectious disease transmission in support of planning for a public health emergency

Most supervisors and managers are not infection control professionals and need to consult with experts such as their facility infection control professional (in the healthcare setting) or their county health department communicable disease professionals for definitive guidance.

We are exposed to disease-producing microorganisms, or pathogens, every day. Potential sources in the workplace may include break rooms, food (especially food left out after celebrations), improperly maintained restrooms, shared keyboards, phones, and other office equipment, as well as ill employees, visitors, and customers (including patients in the healthcare environment).

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Introduction (continued)

Exposure to pathogens does not necessarily lead to illness. Just as we reduce our risk of a driving mishap by observing safe driving practices and using the controls provided (such as seatbelts), many things can be done on an individual and organizational level to prevent disease transmission. The basic principles of infectious disease transmission are essentially the same regardless of setting. Most of the concepts used to control disease transmission in healthcare can be applied to other work settings. Educating employees on some basic principles can help to prevent disease transmission on and off the job, can help to reduce fear in the event of a workplace exposure (or recent media attention focused on a disease outbreak), and may potentially reduce claim frequency.

Basic principles of infectious disease transmission

Several conditions, commonly referred to as the “chain of infection,” must be met for infectious disease transmission to occur. If any one of these conditions is absent, transmission cannot occur. In reality, it is difficult to *completely* remove any of these conditions; it is a best practice to take preventive measures related to each condition as part of an exposure management strategy.

- **Pathogen.** The amount and characteristics of a pathogen affect whether or not a disease is transmitted. A pathogen must be present in sufficient quantities for disease to occur. For example, Hepatitis B cannot be transmitted unless enough of the virus is present to cause disease. In addition, some pathogens are easier to catch (more virulent) than others. These concepts may seem obvious, but are worth mentioning because they are critical to understanding disease transmission. Good housekeeping, good personal hygiene, disinfection (when warranted), and creating a culture where an employee knows he or she is expected to stay home when ill are examples of how this information can be applied. Some pathogens are quite hardy. Hepatitis B, for example, can survive on a soiled surface for 7-10 days. A thorough cleaning with detergent and water is adequate to remove pathogens from surfaces in most environments outside of healthcare. Disinfecting cleaners and other antibacterial products can contribute to the development of resistant strains and should be used judiciously.
- **Reservoir.** A reservoir, simply stated, is a place where the pathogen resides until it is transmitted. A reservoir can be food that has been left at room temperature too long, a keyboard that has been used by an ill employee, an animal or insect, or, in the case of Hepatitis B, another human. A living reservoir (animal, insect, human) may or may not have symptoms. An individual can be contagious and not know they are ill.
- **Portal of exit.** A disease is transmissible only if it has a way “out.” For example, Hepatitis B is only a risk to others if there is potential for exposure to infected blood or other selected body fluids such as semen, amniotic fluid, drainage from an open wound, or the fluids that bathe the joints and lungs.

- **Mode of transmission.** The mode of transmission is the way the pathogen is transmitted. The mode of transmission is a primary consideration when selecting the controls necessary to prevent exposure. Not all pathogens are transmitted the same way. Some are very small and can travel through the air for long distances. Exposure occurs when they are inhaled. Others are contained in larger moisture droplets (still invisible) that are exhaled by an infected individual and remain airborne for a short distance, typically less than three feet, and come to rest on the mucous membranes of our noses and eyes. By far the most common mode of transmission is by touching a contaminated surface or infected body fluid with our hands and then touching our mouths, noses, or eyes without cleansing our hands.
- **Portal of entry.** Closely linked to the mode of transmission, the portal of entry is the way “in” to the exposed individual. Common portals of entry are body openings with mucous membranes such as the eyes, nose, mouth, and genitalia. The skin is an effective barrier when intact, but chapped, cut, or otherwise damaged, non-intact skin can also be a portal of entry.
- **Susceptible host.** A pathogen causes infection only if the host (the person exposed to the disease) is susceptible. Susceptibility varies with the individual. The human body is bombarded with pathogens throughout a typical day. An individual with a healthy immune system destroys most of these invaders before they can gain a foothold and cause infection. Overall wellness – drinking plenty of fluids, selecting healthy choices from a variety of foods, maintaining a healthy weight, managing stress, and getting regular exercise and adequate sleep – are important to immune system health. Vaccinations developed for certain diseases such as Hepatitis B and seasonal influenza provide immunity to these diseases in most people.

Principles of exposure management

Outside the healthcare setting, exposure to a pathogen is typically not a planned event. However, such exposures do occur. It is all too common to “catch” a common cold or other infection that is “going around.” In many cases, we may not remember where or when the exposure occurred. At other times (like in healthcare), we know we are likely to encounter a pathogen. This can also happen at home when we are caring for ill family members. These exposures can – and should – be managed whenever possible to prevent infection.

Think of exposure to an infectious disease in much the same way you would think about exposure to a chemical or other health hazard. Whether or not a health effect results from a *chemical* exposure is dependent upon the toxicity of the chemical, the frequency, duration, and amount of chemical involved in the exposure, and the individual characteristics of the exposed individual. Whether or not exposure to a *pathogen* will result in an infection is dependent on the virulence of the pathogen (how “catchy” it is), how much of the pathogen was involved in the exposure, the duration and frequency of exposure, and the susceptibility of the host.

In 2007, the Centers for Disease Control and Prevention (CDC) published updated guidelines for infectious disease prevention in healthcare. This document, entitled *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings – 2007* describes practical prevention strategies linked to pathogen mode of transmission. Although designed for healthcare, some of the concepts described in these guidelines can be effectively applied in other settings – including the non-healthcare workplace – to help prevent disease transmission and to help you to make informed decisions.

The CDC guidelines – an overview

The CDC guidelines are tiered. “Standard precautions” comprise the first tier. They are similar to, but more broad than, the Occupational Safety and Health Administration’s (OSHA’s) “universal precautions.” Standard precautions are designed to reduce disease transmission from recognized and unrecognized sources of infection. Transmission based precautions, comprising the second tier, are used in addition to standard precautions when the disease is transmitted other ways.

When these concepts are applied judiciously, the risk of infectious disease transmission is reduced significantly.

Standard precautions

Standard precautions apply even if a person does not appear ill. They apply to all body fluids except sweat. This differs from OSHA’s universal precautions, which apply to blood and selected other body fluids collectively termed “other potentially infectious materials.” Standard precautions also apply to mucous membranes and non-intact skin.

“Hand hygiene” is the cornerstone of Standard Precautions. Hand hygiene includes thorough hand washing with soap and running water, applying friction to all surfaces while paying special attention to the cuticles and wrists. It takes 15–30 seconds to adequately wash the hands; singing “Happy Birthday” is an easy way to keep track of the time spent at this task. Antiseptic soaps and cleansers are typically unnecessary outside the healthcare setting if hand washing is done properly.

Hand hygiene goes beyond hand washing, however. Keeping the skin of the hands in good condition is essential. Use of alcohol-based, waterless hand cleansers is an acceptable interim measure unless hands are visibly soiled. These cleansers significantly reduce the number of pathogens on the skin, but are not a substitute for periodic hand washing. Hands should be washed as soon as practical. A few pathogens, such as *C. difficile* and most of the other diarrheal pathogens, are not affected by these cleansers. The CDC has posted hand hygiene guidelines, training resources, and fact sheets on their website.

Use of personal protective equipment (PPE) is essential to effective Standard Precautions. Similar to OSHA’s universal precautions, use of gloves, gowns, face shields and masks is dependent upon the anticipated exposure and/or facility policy.

Use protective gloves when hand exposure is anticipated. Cleansing the hands does not eliminate the need for gloves, and gloves do not eliminate the need to cleanse the hands. Both are needed. Hands should always be cleansed after gloves are removed.

Significant numbers of people are sensitive to latex; exposure can lead to anaphylactic shock in some. You may want to consider selecting nitrile gloves instead of latex. If you do choose latex, stock only latex gloves that are powder-free. Be sure to select lotions and skin care products that are latex-compatible because petroleum-based lotions can degrade latex. The National Institute for Occupational Safety and Health (NIOSH) has published information related to latex hazards in a NIOSH Latex Alert on their website.

“Cough Etiquette” was added to Standard Precautions when the guidelines were updated in 2007. Cough Etiquette includes covering the mouth and nose with a tissue when coughing, and promptly (and properly) disposing of the used tissues and washing the hands. It includes spatial separation of three feet or more. It also includes use of surgical masks on the person who is coughing when wearing such a mask is tolerated and appropriate. It is common for clinics to have masks available for patients to put on as they are waiting to be seen by the doctor. It is unlikely that the surgical mask would be used in the non-healthcare workplace; the individual would more likely remain home until they have recovered sufficiently for the cough to be controlled.

The CDC has developed “Cover Your Cough” posters for download. Posters are available for both the healthcare and non-healthcare settings.

Details on safe injection practices and other healthcare-specific aspects of Standard Precautions can be found on the CDC Website.

Transmission-based precautions

Transmission-based precautions are used when the diagnosis or symptoms suggest a disease is transmitted by ways other than exposure to body fluids or through mucous membrane exposure, and Standard Precautions alone would, therefore, be inadequate. Transmission-based precautions are always used in addition to Standard Precautions. Transmission-based precautions include airborne, droplet, and contact precautions. Contact precautions will not be included in this discussion; control measures are similar to Standard Precautions but more stringent. If you have a need to care for an individual on Contact Precautions, contact an infection control professional.

Airborne precautions

Pathogens such as pulmonary tuberculosis, measles, chicken pox, severe acute respiratory syndrome (SARS), and avian Influenza¹ are transmitted via the airborne mode of transmission. These pathogens typically attach themselves to tiny particles of dust and remain airborne for extended periods. They may travel great distances on air currents before they are inhaled by their next potential host.

¹ Guidance is updated as recommendations change. Because of the uncertainty, current guidance reflects stringent protection, including protective eyewear.

In a healthcare setting, these individuals are typically placed in a private room with special ventilation. The door is kept closed as much as possible. In addition to Standard Precautions, Airborne Precautions include respiratory protection. The caregiver dons a NIOSH-approved and fit-tested respirator, typically a filtering-facepiece respirator that has been approved by the Food and Drug Administration (FDA) for use in infectious disease prevention and treatment. If the patient must leave the room, or is in a home or community setting where others in the home need to be protected, placing a surgical mask (not a filtering-facepiece respirator) on the patient is also acceptable.

Certain invasive healthcare procedures may require use of more definitive protection, such as a powered air purifying respirator (PAPR). These respirators are available in a hooded style that does not require fit-testing. Because of this, the greater ease of use by wearers, and because of the additional protection they provide, some healthcare facilities use these exclusively.

Droplet precautions

Pathogens such as pneumonia, the common cold, and seasonal influenza are transmitted via the droplet mode of transmission. These pathogens are encased in tiny moisture droplets that tend to be sufficiently heavy that they do not remain suspended in air. They typically fall to a surface within about three feet of the source.

Droplet transmission is technically a form of direct contact. In contrast to airborne pathogens, which are inhaled deeply into the respiratory system, pathogens transmitted via the droplet mode typically transmit disease when they land on the mucous membranes of the eyes and nose and the upper airways of a susceptible host.

In the healthcare setting, these individuals are typically placed in a room by themselves, if available. If not, the staff members should be diligent about pulling the curtain to provide a barrier between patients. In addition to Standard Precautions, Droplet Precautions include use of an FDA-approved surgical mask. The caregiver dons the surgical mask if he or she will be providing care within about three feet of the patient. The CDC considers this to be adequate protection because of droplet size. The Cough Etiquette measures described earlier are an important element of droplet precautions, because these droplets can be propelled much farther than three feet if delivered via an unprotected cough or sneeze. If the patient must leave the room, or is in a home or community setting where others in the home will have consistently close contact (within three feet) and need to be protected, using Cough Etiquette and placing a surgical mask on the patient instead of the caregiver(s) is also acceptable.

Although Droplet Precautions do not routinely include eye protection, CDC guidelines recommend protective eyewear for swine influenza and avian influenza as well as for certain tasks involving patients with norovirus.

Contact precautions

Contact precautions are similar to standard precautions. They are specific to the healthcare setting and will not be discussed here. Consult the CDC Website for details on Contact Precautions.

Masks and respirators in infectious disease prevention and treatment

Surgical masks and NIOSH-approved respirators used in the prevention of infectious disease transmission must be approved by the FDA. Even though they look similar, they have important differences. Fluid and flammability resistance is required for surgical masks and filtering facepiece respirators used to prevent or treat infectious disease in healthcare; this is one of the major differences between “nuisance” masks and filtering facepiece respirators found in general industry. Surgical masks and filtering facepiece respirators used in healthcare may not carry the FDA approval on their packaging, but are typically labeled as surgical, laser, dental, isolation, or procedure masks or respirators and a listing of approved devices can be found on the FDA website.

The NIOSH approvals are the same across the two industry sectors; a surgical N-95 respirator meets the same filtration requirements for approval as an N-95 respirator used in general industry. OSHA respiratory protection requirements apply to respirator use in healthcare.

Surgical masks and surgical N-95 respirators may be similar in appearance, but they serve very different functions. The caregiver uses a surgical mask to protect from the larger particles in Droplet Precautions and a fit-tested N-95 respirator (minimum) to protect from the very tiny particles in Airborne Precautions. Surgical masks tend to be made of lightweight material and fit loosely against the face. NIOSH-approved filtering facepiece respirators are made of a thicker fibrous material and must be fit-tested. They typically have two straps and fit snugly against the (clean-shaven) face to be effective. In addition, as previously mentioned, if patients on Droplet or Airborne Precautions must leave the room or are in a patient waiting area, placing a surgical mask on them is appropriate.

Workplace considerations – all settings

Pathogens reside anywhere conditions are right for their survival, including the workplace. Washing dishes thoroughly (preferably in a dishwasher) and keeping microwaves, refrigerators, and break room surfaces clean can help prevent disease transmission. Foodborne pathogens such as norovirus and salmonella can thrive in certain foods if left at room temperature after meals or celebrations. Two hours is generally considered a safe period of time for most foods to remain at room temperature. This time is reduced if the environment is warmer.

Improperly maintained restrooms can also be a haven for pathogens. Cleanliness is important, but it is just as important to assure that adequate soap and paper towels are available for hand hygiene. Soap in pump containers is a better choice than bar soap shared among several individuals.

Shared keyboards, phones, and other office equipment, as well as ill employees, visitors, and customers (including patients in the healthcare environment) can also be a source of pathogens. Cleaning office equipment and counters with a mild detergent and water and creating and sustaining a workplace culture that allows – and encourages – employees to stay home when they are infectious is important. With the rise in telecommuting and other alternative work methods, employees have increased opportunities to remain productive when they feel well enough to work but are still infectious. Sales and other customer service staff may want to keep waterless hand cleaner available to use after shaking hands, especially during the annual influenza season.

Applying the information

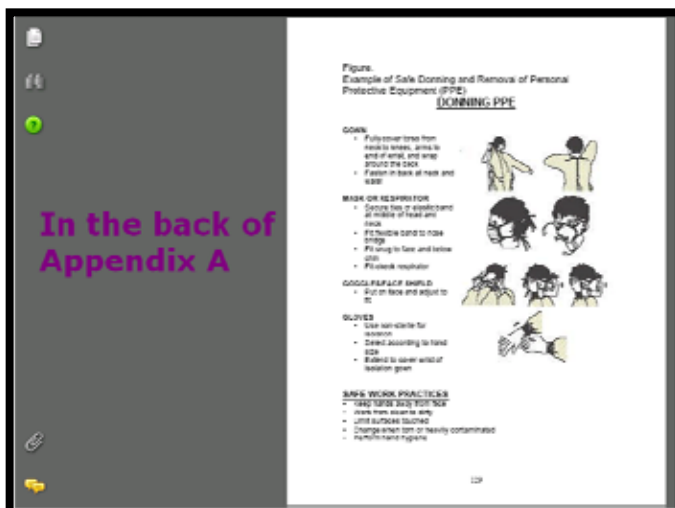
Please remember that the information provided in this document is intended as an informational overview of the prevention concepts and lacks many of the technical details and professional judgment that must be applied in infection control practice. The information is not intended to supplant your facility infection control policy or replace the advice of an infection control professional. However, the information is valuable for supervisors and managers in helping them to discern when professional infection control assistance is needed. In addition, basic information on infectious disease transmission can prove invaluable in a public health emergency.

The CDC has published a matrix of infectious diseases with their recommended precautions (based on mode of transmission) on its website. The tools provided can be used as a material safety data sheet, of sorts, for infectious disease prevention. Using the precaution definitions to guide PPE decisions and the matrix to determine the precautions recommended for a specific pathogen, you can get a general idea of how to protect yourself from a particular infectious disease.

The CDC also has published the entire isolation guideline on its website. The matrix of infectious diseases and their precautions are contained within Appendix A of the lengthy guideline, but Appendix A has also been posted as a stand-alone document for convenience of use. See Figure 1.



Figure 1. The Guideline for Isolation Precautions document is posted on the CDC website. Appendix A is provided as a stand-alone excerpt (circled).

**Figure 4**

Instructions for donning and doffing PPE are found in the back of Appendix A.

Additional information on emerging pathogens and other pathogens of public health interest are also listed on the CDC website. Navigate to the CDC home page www.cdc.gov and use the A-Z Index to find the pathogen of interest. Go to the infection control section of the pathogen-specific web page to

learn about the precautions recommended for that pathogen.

Diseases of interest

Several diseases have captured recent media attention. This discussion will be limited to avian influenza, pandemic influenza, and methicillin-resistant *staphylococcus aureus*.

Avian influenza

Avian influenza (AI) is caused by viruses that occur naturally among wild birds. Many strains of these viruses are common and cause few problems. However, the H5N1 strain is highly pathogenic. It is deadly to domestic fowl and can be transmitted from birds to humans. It has about a 60 percent fatality rate.

At the time of this writing, there is no human immunity and no available vaccine. AI has not yet appeared in the U.S., and public health officials are keeping a watchful eye on disease patterns. It appears that AI may be beginning to spread more easily from human to human, but human-to-human cases are still rare. The primary public health concern is that this virus will mutate into a form that is easily transmissible from human to human, resulting in a deadly worldwide influenza outbreak, or *pandemic*.

Because of the uncertainty related to transmissibility, the CDC currently recommends a combination of Standard Precautions (with meticulous hand hygiene and cough etiquette), Airborne Precautions, Contact Precautions, and eye protection when within three feet.

Pandemic influenza

Pandemic influenza is a virulent human flu that causes a global outbreak, or pandemic, of serious illness. Because there is little natural immunity, the disease can spread easily from person to person. Currently there is no pandemic influenza. However, the potential of global outbreak warrants vigilance and prior planning.

It is important to manage personal pandemic flu preparedness as well as workplace preparedness. Social disruption may be widespread and getting to work may be difficult or impossible. Schools may be closed for extended periods and transportation services may be disrupted. People will need advice and help at work and home.

Social distancing is an important tool in managing a pandemic. Avoiding contact with those who are ill can help to stop the spread. Stay home if at all possible. Plan for a two-week supply of medication and food and teach your children about the importance of proper hand washing.

Resources for personal and business pandemic flu preparedness can be found at the U.S. Government Pandemic Flu Preparedness website. Checklists for personal and business preparedness are posted, in addition to a variety of other tools and resources. OSHA has also published a pandemic influenza resource for employers.

Methicillin-resistant staphylococcus aureus

Staphylococcus aureus is a bacteria commonly carried on the skin or in the nose of healthy people. As many as 25-30 percent of the population is colonized (when bacteria are present, but not causing an infection) in the nose.

This bacterium is one of the most common causes of skin infections in the United States. These infections are usually minor (such as pimples and boils), but sometimes it causes more serious infections such as surgical wound infections, bloodstream infections, and pneumonia.

Over the years, some strains have become resistant to a specific type of antibiotic that includes methicillin, oxacillin, penicillin and amoxicillin. These strains have been dubbed methicillin-resistant *staphylococcus aureus*, or MRSA. Because of the antibiotic resistance, MRSA can be difficult to treat. Standard and Contact Precautions are essential.

Approximately 1 percent of population is colonized with MRSA. MRSA is most frequently associated with healthcare facilities such as hospitals, nursing homes, and dialysis centers, especially in those with weakened immune systems. In fact, in the past, infections with MRSA were almost exclusively linked to healthcare. However, MRSA is sometimes acquired by persons who have not been hospitalized or had a medical procedure within the past year, and this pathogen is becoming common in the community. MRSA that is associated with community exposure rather than healthcare is called community-associated MRSA, or CA-MRSA.

CA-MRSA infections are usually skin infections (pimples, boils, etc.) in otherwise healthy people. It commonly occurs in clusters among athletes, military recruits, children, and prisoners. It is also common in certain ethnic groups such as Pacific Islanders, Alaskan Natives, and Native Americans.

CA-MRSA is transmitted via close skin-to-skin contact, especially if you have openings in the skin such as cuts or abrasions. Contaminated items and surfaces, crowded living conditions, and poor hygiene increase the risk.

The same measures applied in Standard Precautions can be used in preventing CA-MRSA. Public health officials specifically recommend the following preventive measures:

- Cover your wound. Drainage can spread the bacteria.
- Clean your hands. Frequent hand cleansing, especially after changing the bandage or touching the infected wound
- Do not share personal items. Avoid sharing personal items, such as towels, washcloths, razors, clothing, or uniforms that may have had contact with the infected wound or bandage. Wash soiled sheets, towels, and clothes promptly and dry them thoroughly. Use a barrier (e.g., clothing or towel) between your skin and shared equipment.
- Communicate. Tell any healthcare providers who treat you that you have or had a staph or MRSA skin infection

MRSA treatment considerations: Most MRSA infections are treatable with antibiotics. It is important to complete the entire course as prescribed, even if you feel better. Many times having the abscess or boil drained by a healthcare provider will resolve the infection. Either way, if you don't see improvement in a few days, contact your healthcare provider again.

Recurrence is not unusual. It is important to follow the prevention steps carefully, even in the absence of infection.

The CDC has published several good resources related to MRSA on its website, including educational materials for employees.

Bloodborne pathogens

Standard or universal precautions are effective against hepatitis B, hepatitis C, and HIV. Resources on bloodborne diseases abound. An especially useful resource for employees is an informational booklet published by the Centers for Disease Control and Prevention's National Center for Infectious Disease entitled, *Exposure to Blood: What Healthcare Personnel Need to Know*.

Resources for emergency management

There are many Internet resources available on bioterrorism preparedness and response. Although they will not be discussed here, these resources are provided for your reference:

- Department of Homeland Security <http://www.dhs.gov/index.shtm>
- Public Emergency Readiness <http://www.ready.gov/>
- CDC Emergency Management (and Bioterrorism) <http://www.bt.cdc.gov/>
- One-stop access to US Government pandemic flu information <http://www.pandemicflu.gov/>

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