Infection Control for Healthcare Professionals

Introduction

About This Course

Healthcare professionals are responsible for monitoring the performance of all personnel who are under their authority, licensed or not, about infection control techniques. Failure to adhere to these principles is considered unprofessional conduct and could subject the healthcare professional to disciplinary action, revocation of license and/or professional liability. Not only are there professional consequences, but failure to adhere to infection control standards also puts you and your patients at risk for adverse health outcomes. This three-part program will update your ability to apply scientifically accepted infection-control principles to reduce the transmission of pathogens.

Goal and Objectives

The goal of this three-part program is to update healthcare professionals' ability to apply scientifically accepted infection-control principles to reduce transmission of pathogens. After studying the information presented here, you will be able to:

- Recognize the benefits of adhering to standards of infection control and describe the professional's responsibility to adhere to these practices and the consequences of failing to comply.
- Recognize the professional's responsibility to monitor infection control practices of those for whom he or she is responsible and intervene as necessary.
- Describe how pathogenic organisms may be spread in healthcare settings, identify those factors influencing the outcome of exposure, list strategies for preventing transmission of pathogenic organisms, and describe their application in practice.
- Define engineering controls and work practice controls and identify a hierarchy of exposure prevention strategies.
- Describe specific practices and settings that raise exposure potential to healthcare workers and patients and identify work practice controls that prevent exposure.
- Recognize the circumstances that require the use of personal protective equipment and identify these specific barriers.
- Identify a professional's responsibility for maintaining a safe patient care environment and recognize nonspecific disease findings that prompt evaluation by healthcare providers.
- Recognize the role of occupational health strategies in protecting healthcare providers and patients and recognize the importance of the correct application of reprocessing methods.
- List specific occupational health strategies in preventing HIV, hepatitis B virus, and tuberculosis (TB) in healthcare providers and identify resources for evaluation of

healthcare workers infected with these conditions.

Course Content

PART 1 OF 3

The goal of Part 1 is to present modes of disease transmission and effective strategies for prevention and to inform clinicians that failure to adhere to standards could lead to disciplinary action.

Part 1 in this series focuses on the first two of six elements that make up this required coursework. These elements are: 1) professional responsibility; 2) modes and mechanisms of transmission of pathogenic organisms; 3) engineering and work practice controls; 4) selection and use of barriers or personal protective equipment; 5) infection control principles and practices for cleaning, disinfection, and sterilization; and 6) prevention and control of infectious and communicable diseases in healthcare workers.

The Buck Stops Here

Let's say you work in a clinic. A patient calls with complaints of a rash. She mentions that her nephew had chickenpox two weeks ago. She arrives an hour later and makes herself comfortable in the waiting room with other patients. Are you guilty of "failure to anticipate a potentially infectious condition and take appropriate action?" Now, put yourself in the hospital setting. You take report on an ED transfer who has had night sweats and a cough. You walk into his room without a respirator mask. Is it just an "oops" moment, or are you guilty of the same infraction? Consider a home care worker, who spills a urine specimen and wipes it up with a paper towel. Is this unprofessional conduct? According to the law, it certainly is.

As you can see, the potential for transmission of pathogens is present regardless of where healthcare is delivered. Each of these examples was potentially avoidable had the clinicians anticipated the possibility of a diagnosis, identified potential infectious conditions and chosen appropriate barrier devices, and used the safest work practices possible to protect themselves and their patients from infection. Some state health codes now place responsibility on the healthcare professional to recognize the possibility of the spread of communicable disease and to take measures to prevent such spread.

For example, to ensure public safety, many states have passed legislation that requires nurses and other licensed healthcare workers to complete coursework in infection control and barrier precautions. The intent of this legislation is to promote use of safe work practices and engineering controls to reduce the opportunity for patient and employee exposure.

In addition to this continuing education, healthcare professionals are responsible for monitoring the performance of all personnel, licensed or not, under their supervision regarding infection control techniques. Failure to adhere to these principles is considered unprofessional conduct and could subject the nurse or other healthcare professional to disciplinary action, revocation of license, or professional liability.

Not only are there professional consequences, but failure to adhere to infection control standards also puts you and your patients at risk for adverse health outcomes. Read on to learn how to avoid these dire hazards.

A Chain of Events

An infectious disease cannot spread from one person to another unless there is an intact chain of transmission that includes the infectious agent, a reservoir, an exit from the reservoir, an environment conducive to transmission of the infectious agent, an entry into a new host, and a susceptible new host. You can prevent the spread of disease by breaking any link in the chain.[1] (Level ML)

A chain of infection begins with the pathogen or infectious agent. Bacteria, such as *Staphylococcus aureus;* viruses, including herpes simplex; fungi, including *Candida albicans;* and parasites, such as cryptosporidium, are all potential culprits. The reservoir — or source of the infectious agent — is any person, animal, plant, or substance in which an infectious agent normally lives and multiplies. A reservoir can be inanimate. For example, salmonella, a common cause of food poisoning, is found in improperly prepared egg products or poultry. In this case, the processed food is considered the inanimate reservoir.

A “common vehicle” is the term used to describe contaminated material that serves as a means by which an infectious agent can be transported. Take, for example, outdated, multidose containers of medication or diluent. These vials can get contaminated and become a breeding ground. Also, be wary that a person may actually be a carrier of an infectious agent and pass it along unknowingly.

Next in the chain of events come the portals of exit — sneezing, draining lesions, and blood and other body fluids are all means by which a pathogen can escape. To infect another person, however, there must be a portal of entry. Portals of entry include:

- GI tract
- Skin
- Placenta
- Genitourinary system
- Respiratory tract
- Mucous membranes
- Percutaneous injuries
- Points affected during invasive procedures
- Vascular access

Pathogens can be transmitted by direct or indirect contact. Agents can be spread by droplet and become airborne, as in the case of TB or measles. Transmission can even occur with the help of a vector.[1] (Level ML) Such is the case when mosquitoes transmit malaria to humans. And last, the chain is complete when there is a susceptible host — a person lacking resistance to the offending agent.

Improving the Odds

Factors intrinsic to the susceptible host influence the outcome of exposure to pathogens. Advanced age at one end of the spectrum and prematurity at the other end can affect the competence of organ systems to resist infection. Chronic diseases also impair host defenses.

The Joint Commission, which devotes an entire chapter to infection control in its Comprehensive Accreditation Manual for Hospitals, also expects hospitals to identify infection control risks based upon characteristics of the population served. The Centers for Medicare and Medicaid Services echoes high expectations for infection prevention and control.[2]

A number of natural barriers serve to protect the body from invasion by microorganisms. Intact skin, tears, cough and gag reflexes, respiratory cilia, and gastric acidity function as impediments to the influx of bacteria that would colonize or invade deeper tissues. Anesthesia, intubation, surgery, and medication often inhibit — at least briefly — these functions.

Once tissues have been infected, the inflammatory response and humoral and cell-mediated immunities are activated. Conditions such as renal failure, diabetes, and lymphocytic leukemia, as well as medical treatments (e.g., use of steroids, chemotherapy) can impair or suppress these functions.

Virulence of the microorganism can contribute to the morbidity of the susceptible host. Pathogens may secrete exotoxins that have a local or systemic impact. Strains of pseudomonas that secrete an exotoxin can cause a rapidly progressive necrotizing pneumonia, while certain strains of staphylococcus secrete a toxin responsible for toxic shock.

The size of inoculum (microorganisms or infectious material) may dictate whether infection occurs. Although a small number of influenza virions or tuberculosis bacilli are sufficient to produce disease in the susceptible host, often a large inoculum is more likely than a small one to produce illness. A classic example is salmonella, which is unlikely to produce infection when ingested by a healthy host unless many thousands of organisms are present. Similarly, a small inoculum of blood on mucous membranes or broken skin is less likely to result in transmission of an organism like HIV than is a large inoculum. The duration of contact between pathogenic organism and its portal of entry also correlates with the likelihood of subsequent infection. For this reason, contaminated skin and mucous membranes should be promptly washed free of inoculum.

The route of exposure can make a difference in the likelihood of infection or the nature of that infection, depending on the pathogen. Deposition of klebsiella in a surgical wound could result in a wound infection, although ingestion of large numbers of the same organism would not be expected to produce disease. Ingestion of staphylococcus that had multiplied in improperly stored potato salad might result in gastroenteritis, while growth of the same pathogen in nasal packing could result in toxic shock syndrome.

The Weakest Link

A chain is only as strong as its weakest link. With that in mind, winning the battle means breaking a link in the chain of transmission. Here are some ways you can dismantle the sequence. Begin by controlling reservoirs.

- Recognize potential reservoirs to minimize later problems. Take, for instance, a unit clerk who has never had varicella. If she develops a febrile illness as her friends' children are recovering from chickenpox, encourage her to stay home until the nature of her illness becomes clear.
- Eliminate pathogenic hazards in the clinical setting. Throw away outdated containers of skin cleansers, disinfectants, and diluents. These may have become contaminated and represent a potential risk to patients and healthcare workers using them.
- Control the route of transmission by becoming familiar with how and when common communicable illnesses present clinically. Keep your index of suspicion keen and rely on diagnostic measures to determine whether additional steps such as isolation or therapeutic intervention are required.
- Be wary about the environment. Dirty storage areas may contaminate supplies, and infectious secretions can contaminate surroundings. Remember that some pathogens survive in dried secretions long enough to infect others coming into contact with them. Carpets might be appropriate in adult waiting and consultative areas, where soiling with secretions is improbable. A pediatric waiting area, on the other hand, deserves a more impermeable surface that can be sanitized more effectively. While bookshelves in the secretarial area should be dusted regularly, shelves with patient care materials should be enclosed and regularly cleaned with appropriate detergents.

Next, consider strategies that will interrupt the route of transmission. Generally, this takes the consistent use of simple procedures. Handwashing before and after patient contact is essential. Appropriate use of barriers can minimize the risk of contamination as well.[1] (Level ML)

The level of sterilization or disinfection of patient care equipment is generally determined by whether the device comes into contact with intact skin, mucous membranes, or sterile body areas. However, proper management of the patient care environment is trickier and depends on the clinician's ability to anticipate potential pitfalls. Consider the case of a patient with a positive blood culture. The astute clinician performs a prompt initial evaluation, and patient triage will lead to rational patient flow, isolation precautions, or cohorting when necessary. In some situations, transfer of patients is called for.

When it comes to the environment, clinicians may have to direct other departments, including housekeeping and engineering, to be sure windows, air conditioners, and air vents are cleaned on a regular basis. Waste management is vital as well. Just as appropriate patient flow is important, the flow of used, potentially contaminated materials and equipment is paramount. Disposable sharp instruments must be placed in puncture-resistant, point-of-use containers. Disposable materials that have been in contact with patients but aren't visibly contaminated with blood or body substances, should be placed in a covered container lined with an impermeable

plastic bag. Visibly soiled material must be discarded in containers dedicated for regulated medical waste and later disposed of in the approved fashion.

Contaminated reusable equipment must be taken to a “dirty” utility area to be washed and disinfected or sterilized. Instruments, especially those contaminated with blood or body substances, should be transported from the point of use to the dirty utility area in a covered container. Clean instruments, equipment, linens, and disposable supplies must not be stored in the dirty utility area, and personnel leaving the dirty utility area must wash their hands. Handwashing must be done in sinks separate and distinct from the sinks used in the reprocessing of contaminated equipment. Dirty linen should always be held away from your uniform so that it doesn’t contaminate your clothing. Linen/laundry bins must be easily accessible.

Because transmission can only take place when the host is susceptible, vaccination and pre- and post-exposure prophylaxis are imperative. Patients or healthcare workers can be made nonsusceptible to certain communicable diseases through immunization. Immunity to rubella and rubeola is recommended and sometimes required of healthcare workers. Immunization to hepatitis B is strongly recommended, especially for those having regular exposure to blood and tissue. Postexposure prophylaxis should take place immediately should a needlestick occur.

The Big Picture

All of the aforementioned infection reduction mechanisms (controlling reservoirs, handwashing, isolation techniques, etc.) should be part the entire hospital’s infection control program. Each Joint Commission-accredited hospital is expected to have an effective infection control program in place that will minimize healthcare-associated infections. The Joint Commission’s standards, which hospitals are required to comply with, include:[3]

- Identification of individual(s) responsible for the infection prevention and control program: This individual or group of individuals has clinical authority over the program and must have expertise in infection prevention and control or the ability to consult with an expert as needed for decision-making. Responsibilities include the development and implementation of policies governing the control of infections and communicable diseases in addition to developing a system for identifying, reporting, investigating, and controlling infections and communicable diseases.

- Allocation of resources for the infection prevention and control program: This is an important part of the development of the plan and its management. Resources include qualified infection prevention staff and other key team members, information, laboratory services, equipment, and supplies.

- Identification of risks for acquiring and transmitting infections: This is a team effort and includes infection prevention staff, medical staff, nursing, and leadership in addition to community leaders as appropriate. This identification of risks for acquiring and transmitting infections should be based on geographic location, community, and

population served as well as the care, treatment, and services provided. Additional risks are identified through the analysis of surveillance activities and other infection control data. These risks are reviewed annually and as significant changes occur.

- Development of goals to minimize the possibility of transmitting infections based on the identified risks: The identified risks should be prioritized based on level of probability and potential for harm. The goals address these risks and should include limiting unprotected exposure to pathogens; limiting the transmission of infections associated with procedures; limiting the transmission of infections associated with the use of medical equipment, devices, and supplies; and improving compliance with hand hygiene guidelines. The goals should then result in activities based on relevant professional guidelines and sound scientific processes.

- Development of an infection prevention and control plan: This is a written document that includes a written description of the activities to minimize, reduce, or eliminate the risks of infection. The plan includes all hospital functions and components; activities are developed using evidence-based national guidelines or expert consensus when guidelines are absent. The infection prevention and control plan also includes the process for outbreak investigation and methods to communicate infection surveillance and control information to appropriate external organizations. Communication methods are also addressed, including those used to communicate with licensed independent practitioners, staff, visitors, patients, and families.

- Preparation for an influx of potentially infectious patients: A written response plan is required. It must describe how the facility will respond to an influx of potentially infectious patients as well as methods to manage these patients over time. An important component of this process is the identification of resources, which may include local, state, and federal public health systems. Although specifics on the exact infectious agent may be unknown, current clinical and epidemiological information can aid in planning efforts and information about potential emerging infections needs to be shared with licensed independent practitioners.

- Implementation of the infection prevention and control plan: Activities must be practical, collaborative and inclusive of everyone who works in the hospital. The use of standard and transmission-based precautions is required. Information should be available to staff as well as to patients and their families. This includes communication of responsibilities for preventing and controlling infection of licensed independent practitioners, staff, visitors, patients, and families including hand and respiratory hygiene. A variety of media may be used. Infection prevention, surveillance, and control information is also communicated to local, state, and federal authorities in accordance with law and regulation. Interfacility communication throughout the continuum of care regarding infectious patients is expected as well. The plan should also include outbreak investigation and methods to safely store and dispose of infectious waste.

- Reduction of the risk of infections associated with medical equipment, devices, and supplies: This includes everything from cleaning and low-level disinfection to high-level disinfection and sterilization. Processing medical equipment requires competency and attention to the details and steps outlined by the manufacturer. Attention also needs to be focused on the disposal or storage of medical equipment, devices, and supplies.

- Prevention of transmission of infectious disease among patients, licensed independent practitioners, and staff: This includes screening for exposure and immunity to infectious diseases and the referral for assessment and potential testing, prophylaxis/treatment, or counseling in the event that contact is anticipated or has occurred.

- Establishment of an annual influenza vaccination program to offer the vaccine to licensed independent practitioners and staff: An essential part of this program is education about the vaccine; nonvaccine control and prevention measures, and the diagnosis, transmission, and effects of influenza. Reasons for declining vaccination should be reviewed at least annually. An incremental goal for vaccination should be set each year with the goal of achieving 90% by 2020 as recommended by the U.S. Department of Health and Human Services. Vaccination should be offered at convenient times and locations, and stakeholders should be kept apprised of vaccination rates.

- Evaluation of the effectiveness of the infection prevention and control plan: The findings should be communicated at least annually and used when revising the plan. Evaluation includes a review of the infection prevention and control plan's prioritized risks and goals and implementation of the plan's activities.

The Joint Commission expects hospitals to reduce the risk of hospital-acquired infections. Compliance with The Joint Commission's standards, the Centers for Disease Control and Prevention (CDC) recommendations, and the implementation of suggestions made throughout this module will help achieve this goal.

Put the Lid on Transmission

"An ounce of prevention is worth a pound of cure," deserves amplification when it comes to infection control. Hand hygiene and isolation precaution strategies are mainstays in preventing cross-infection and protecting both patients and healthcare workers and are the most important precautions for preventing the spread of infection.

In 2002, the CDC issued guidelines for hand hygiene in healthcare settings.4 (Level ML) These guidelines were developed to improve hand-hygiene practices and reduce transmission of pathogenic microorganisms to patients and healthcare personnel.4 (Level ML) A summary of the routine hand hygiene and hand-antisepsis practices recommended by the CDC is provided below. Surgical hand antisepsis related to operative procedures is not included but is discussed in the guidelines.

Hand decontamination using an alcohol-based hand rub is recommended:[4]

- If hands are not visibly soiled
- Before having direct contact with patients
- Before donning sterile gloves for the purpose of inserting an invasive device that doesn't require a surgical procedure, such as inserting a central or peripheral intravascular catheter or indwelling urinary catheter
- After contact with a patient's intact skin, such as following a pulse check
- After contact with body fluids, excretions, mucous membranes, nonintact skin, and wound dressings if hands are not visibly soiled
- If moving from a contaminated body site to a clean body site during patient care
- After contact with an inanimate object such as medical equipment that is near the patient

Handwashing with either a nonantimicrobial or antimicrobial soap is recommended:[4]

- When hands are visibly dirty or contaminated with proteinaceous material or blood
- Before eating and after using the restroom
- If there is suspected or proven exposure to Bacillus anthracis or other spore-forming agents, such as Clostridium difficile

Antimicrobial-impregnated wipes such as towelettes may be an alternative to handwashing with a nonantimicrobial soap; however, they are not a substitute for alcohol-based rubs or handwashing with an antimicrobial soap. There is strong evidence that artificial nails and jewelry such as rings harbor bacteria and fungi, but whether they cause a greater transmission of pathogens or contribute to healthcare-associated infections is unknown and an area for further research.[4] (Level ML)

Effective handwashing technique requires vigorous rubbing of all surfaces of the hands and fingers against each other with water and a cleanser for a period of 15 seconds, followed by thorough rinsing and drying with a disposable towel. Hot water should be avoided, because it increases the risk for dermatitis, which facilitates pathogen invasion. Cloth hand towels for drying aren't recommended for use in a healthcare setting. Liquid, bar, leaflet, or powdered nonantimicrobial soap is acceptable, but bar soap is susceptible to harboring bacteria. If a bar is used, it should be small and stored on a soap rack to facilitate drainage and drying.[4]

To effectively decontaminate hands with an alcohol-based rub, apply the product to the palm of one hand and rub hands together, covering all surfaces of the hands and fingers until the hands are dry.

Products for hand hygiene should be placed in convenient areas for users and appropriately gentle to the skin. Products that are irritating or too far from the area where they are needed are less likely to be used consistently. It is also advisable that facility-approved hand lotions be made available to staff to promote healthy skin. Keep in mind that scented lotions may

exacerbate respiratory symptoms for those who are sensitive to them, and some lotions are not compatible with the hand hygiene products and gloves used in healthcare settings. Lotions should be dispensed from pumps or bottles rather than jars that require healthcare workers to scoop out the product with their hands. Artificial nails, gel nails, and nail overlays should not be worn. Some facilities allow short nails with fresh, unchipped nail polish.

Handwashing is such an important part of controlling infections in hospitals that The Joint Commission based one of its National Patient Safety Goals on handwashing. During their visits to patient units, surveyors observe staff members entering and leaving patients' rooms and note if they washed their hands. If the surveyors determine that there is an unacceptable level of compliance, a formal requirement for improvement is cited and the hospital will be required to develop an action plan to correct the deficiency.

Isolating the Problem

Isolation precautions refer to the procedures used in dealing with all patients to prevent inadvertent transmission of microorganisms from patient to caregiver, caregiver to patient, and patient to patient. Current guidelines provide for two tiers of precautions. Standard precautions are the first tier and primary strategy for nosocomial infection prevention. Transmission-based precautions are the second tier. They are directed at interrupting transmission of epidemiologically important pathogens when a specific infective entity is suspected or identified and where additional precautions beyond standard precautions are needed.[1] (Level ML)

Standard precautions are an example of an interactive approach applied routinely to all patients. Nothing has to be known about the source patient because the same measures of barrier protection to prevent soiling of skin and mucous membranes are applied equally to all. Barriers appropriate to the activity, such as gloves, protective eyewear, and impermeable gowns, should be used to prevent any and all contact between skin and mucous membranes and blood. Standard precautions combine the principles of universal and body substance precautions. Generally, contact with tears and sweat does not require barrier protection.

Transmission-based precautions are designed for patients documented or suspected to be infected or colonized with highly transmissible or epidemiologically important pathogens for which additional precautions beyond standard precautions are needed. There are three types of transmission-based precautions:

1. **Airborne precautions** are implemented where highly contagious pathogens may be present and can be spread by airborne droplet nuclei that remain suspended in and can be widely dispersed by air currents over considerable distances. These particles remain infective over time and distance and can be inhaled by people who have not even been in the same room with the infected person. The most common agents this applies to are *Mycobacterium tuberculosis,* which causes tuberculosis; the rubeola virus, which causes measles; and varicella-zoster virus, which causes chickenpox. Patients who have one of these pathogens or are suspected of having one of these pathogens should be placed in a monitored negative-pressure room that provides six to 12 air changes per hour. These airborne-isolation rooms safely contain and remove the infectious particles. Healthcare

personnel are to wear respiratory protection with a National Institute for Safety and Occupational Health certification of N95 or higher to enter the room. In the case of measles or chickenpox, susceptible people should not enter the room if other caregivers who are immune are available. If entry by susceptible people is unavoidable, respiratory protection must be used. If the patient is required to be out of the airborne-isolation room for testing, the patient should wear a plain surgical mask to contain any respiratory secretions.[1]

2. **Droplet precautions** are implemented where pathogens are transmitted by infectious droplets. These can be generated by coughing, sneezing, and talking or during procedures such as suctioning, endotracheal intubation, cough induction, chest physiotherapy, and cardiopulmonary resuscitation. The pathogen can be transmitted directly from the respiratory tract of the infected person to a susceptible mucosal surface of the recipient or indirectly through contact with an object contaminated in the environment. Unlike infections spread by the airborne route, infections spread through droplets are believed to travel a distance of 3 feet or less. Segregation from others is desirable but less critical than with airborne precautions. Masks are necessary when working within 3 to 6 feet of the patient. Special ventilation is not necessary. Infections spread through the droplet route include *Bordetella pertussis,* influenza virus, adenovirus, rhinovirus, *Mycoplasma pneumoniae,* severe acute respiratory system-associated coronavirus (SARS-CoV), group A streptococcus, and *Neisseria meningitidis.*[1]

3. **Contact precautions** are implemented for patients known or thought to be infected or colonized with epidemiologically important microorganisms that can be transmitted by direct or indirect contact. Examples include methicillin-resistant *Staphylococcus aureus* (MRSA), scabies, and *Clostridium difficile.* Wear gloves for contact with patients and immediate surroundings. (Gloves don't have to be sterile unless a specific procedure requires sterility.) As clothing can also be contaminated by contact with the patient or items in the patient's environment, an isolation gown should be worn as well.[1] Gloves are always discarded as the wearer leaves the patient environment, and hands need to be washed immediately. Similarly, gowns should be discarded in appropriate receptacles.

There are certain instances where more than one type of transmission-based precaution may be needed. For example, airborne and contact precautions should be used with a patient who has disseminated shingles to prevent spreading it to other individuals. Another example is the person who has seasonal influenza as well as a skin infection with MRSA. That patient would need droplet precautions for the influenza and contact precautions for the MRSA. The CDC provides detailed recommendations for the type of precautions to use based on the infection or condition, but it is essential to follow standard precautions with every patient, every time.[1]

PART 2 OF 3

The goal of Part 2 is to understand the hierarchy and application of preventive strategies, including engineering controls, work practice controls, barriers, and personal protective

equipment.

Risky Business

Just walk into a hospital and you become a potential target. Virtually anyone who works in a healthcare setting is at risk for exposure to pathogens. You don't have to be a physician to be at risk during surgery. Similarly, you need not be a nurse to come in contact with infectious material. Direct providers, assistants, ancillary personnel, and patients are all in a potentially perilous situation. And let's not forget the volunteers and medical and nursing students who also are surrounded by these hazards.

When we left off in Part 1 of this series, our focus was professional responsibility pertaining to infection control and modes and mechanics of disease transmission. Now we'll consider the interaction between properly designed equipment, devices, and instruments that remove or isolate hazards **(engineering controls)** and procedures designed to reduce or eliminate exposure to infection **(work practice controls)**.

These concepts have evolved primarily for control of exposure to bloodborne pathogens such as hepatitis B and HIV, where exposure is percutaneous or via mucous membrane/nonintact skin, and to TB, where transmission occurs via the respiratory tract (airborne). Percutaneous exposure is the result of injury through the skin, while mucous membrane/nonintact skin exposure comes in the form of direct contact or splashes/sprays with blood or body fluid. Parenteral exposure may occur with injection of infectious material, infusion of contaminated blood products, and even transplantation of contaminated tissues or organs.

Don't Get Stuck

Certainly, there are situations that place healthcare workers of various disciplines at greater risk of exposure to potentially infectious materials. Take, for example, percutaneous injury. This type of exposure is most likely to occur during the use of sharps, especially when work practices fail to address obvious risks, such as:

- Using exposed needles
- Recapping used needles
- Manipulating used needles or other sharps by hand
- Removing scalpel blades
- Blind suturing
- Using fingers and hands in the vicinity of or opposing a suture needle
- Passing needles or sharps from one person to another
- Failing to account for sharps used in a procedure
- Disposing of used sharps

Blind manual exploration of body sites containing bone, tooth, or metal fragments is similarly hazardous.

We can all appreciate the gravity of risk when injuries occur in an operative site, both to the

patient and the healthcare worker. But it's not only in the OR where we need to concern ourselves with percutaneous injury. Consider, also, that sharps lost or left unaccounted for during a procedure are a serious risk for anyone in the vicinity, even hours later. No one would take lightly getting stuck because a sharp instrument was left concealed in a dressing or drape. Personnel at all levels are at risk when a needle or scalpel blade has been disposed of improperly with other trash.[5]

Safe Injection Practices

Safe injection practices must also be used to protect patients. Failure to do so has resulted in the transmission of bloodborne viruses such as hepatitis B and C to patients and the notification and testing of thousands of others who may have been exposed. Injection with infectious material can occur during the administration of parenteral medication; sharing of blood monitoring devices, including meters and related supplies; and infusion of contaminated blood products or fluids. Unsafe injection practices can result in disciplinary action by licensing boards as well as malpractice suits.

Asepsis must be maintained throughout all aspects of the injection process. Hand hygiene should be performed before beginning medication preparation, and a "clean" area away from potentially contaminated items should be designated for this purpose. Syringes, IV tubing, medication vials, equipment, and anything else that is potentially contaminated should be discarded. Bloodborne pathogens as well as bacteria and other microbes can be present in the absence of visible evidence, such as cloudiness or blood. A new, sterile syringe and needle must be used to draw up medication. The syringe may not be used on more than one patient, even if the needle has been changed, whether it's being injected or infused through IV tubing. All components of an IV set regardless of the distance from the IV insertion site are single use for that patient only. Bags of IV solution are not to be used as a common-source supply for more than one patient. Other devices that should be restricted to single-patient use are peripheral capillary blood-sampling devices and lancets.

Medication vials must also be handled with care. After opening, the rubber septum should be disinfected with alcohol before access. Never enter the vial with a needle or syringe that has been used on another patient. To prevent contamination, needles and other access devices should not be left in place after withdrawing of medication or fluid. Single-use vials should be used on one patient and never combined for later use. Multidose vials should be used for one patient when possible. Any vial that has reached its expiration date or is questionably contaminated should be discarded.

Evaluation and Surveillance of Exposure Incidents

Any sharp device has the potential to cause injury and disease, so it's important to evaluate staff, circumstances, and locations where exposures occur to develop a comprehensive sharps safety program. This includes the evaluation of safer devices and ongoing training. The availability of safety products should be universal, with the goal of eliminating all devices without a safety feature. Safety features can be active or passive.

Consideration in selection of safety devices also needs to include the risks involved and area where the items will be used. Certain items, such as butterfly catheters, cause more injuries. Hollow-bore needles pose a higher transmission risk.[5] All needles and other sharps must be disposed of in a puncture-resistant container whether or not there is a safety device in use.

Engineering Controls

Sharps-related injuries can be reduced or eliminated through a combination of engineering controls that will eliminate or isolate the hazard. While the best option is to avoid the use of needles altogether, consider a needleless delivery system for IV administration of medication, fluids, and nutrition. With such a system, withdrawal of blood specimens and piggybacks can be achieved using blunt connectors instead of needles.[5]

Where the use of needles is necessary, continuously shield the needle from accidental contact or cover the needle immediately after use. As for disassembly of sharps, such as scalpels, follow a protocol where a clamp or other device secures the blade so that it can't slip and cause a cut.[5]

Equipment that can cause splattering, such as centrifuges, should be designed with covered, sealable blood-tube carriers and locking lids. Biological safety hoods should be available and used for the transfer of potentially contaminated material, such as blood specimens. Puncture-resistant containers that seal closed must be used for transfer of such specimens.

Work Practice Controls

When you alter the manner in which a task is performed to eliminate the likelihood of exposure, you are using a work practice control. Such is the case with recapping needles. Although recapping of needles is strongly discouraged, there are settings where it's done. In those instances, use a one-handed "scoop" technique: Insert the needle into the cap while it rests in a cup, in a test tube rack, or on a stable surface. This procedure eliminates a two-handed recapping situation, which poses a substantial risk of injury from the needle puncturing the hand holding the cap.

As for suturing, be on your guard. Suturing must not be done against an opposing finger, and techniques must be designed to minimize blind suturing where the operator's or assistant's hand may be in the vicinity of the needle. Similarly, passage of sharps from one person to another requires the use of a designated safe zone so that accidental punctures don't occur.

There will be instances where sharp objects cannot be shielded. Take, for example, the exploration of wounds containing bone, tooth, or metal fragments. Work practice controls include using instruments or special protective gloves — not fingers.

While some of these strategies seem to "go without saying," they are worth reiterating. Always use care in the handling and disposing of needles and other sharp objects. And remember that small modifications in procedure will reduce risk — using forceps, suture holders, or other instruments for suturing; not holding tissue with fingers; and never leaving sharps on a field are

but a few examples.

Occupational Safety and Health Administration (OSHA)
Standards for Work Practice Controls[6]

- Write exposure control plan
- Instruct employees on when and how to perform proper handwashing
- Educate personnel to handle, label, and transport specimen containers safely
- Make sure equipment is decontaminated before servicing; if it's unable to be decontaminated, label the portions that remain contaminated
- Instruct employees not to eat or drink, smoke, apply cosmetics or lip balm, or handle contact lenses in contaminated work areas
- Do not store food or drink in refrigerators or freezers or on shelves or countertops where potentially infectious materials are present
- Train employees who perform procedures that may create splashing or spraying of blood or other potentially infectious materials to perform such procedures in a manner that reduces risk of exposure
- Instruct employees not to mouth pipette/suction blood or other potentially infectious materials

The Dreaded Splash

The risk of blood or body fluid splashes to mucous membranes or bare skin may occur during any surgical or invasive procedure, such as vascular access, intubation, or suctioning of the pulmonary tree. Wound care also carries a risk of exposure. Similarly, cleaning contaminated work surfaces, equipment, and instruments poses risk for skin or mucous membrane exposure and percutaneous injury.

Routine use of appropriate protective clothing, including gloves, gowns, and face shields, is mandatory.[1] Technicians and other ancillary personnel who are involved in maintaining and cleaning equipment and work surfaces are also at risk of exposure from environmental contamination.

Prompt cleanup of spills using a deliberate protocol to suppress splashing and spread of the contaminating material, disinfection of the spill with fresh sodium hypochlorite solution, and removal of the spilled material will minimize the potential exposure to others.[7]

The Air Up There

Airborne transmission poses unique challenges. The use of both engineering and work practice controls for prevention of airborne exposure has evolved to the greatest degree for TB. The risks increase with inadequate ventilation, prolonged stays in the immediate vicinity of the source patient, inability to control aerosol production from the source patient, and failure to identify cases.

Hospital patient care areas where susceptible patients are seen, whether recognized or not,

should have adequate ventilation. Patients known to have infectious respiratory secretions must be placed in negative-pressure rooms where there are six or more air exchanges per hour.[1] Ultraviolet lighting designed for these areas may also reduce the number of infectious airborne droplet nuclei.[8] Another alternative, typically used only temporarily, is a tent where negative pressure within the tent is maintained and the air exchanges are achieved through a high-efficiency particulate air (HEPA)-filtered fan.[9]

When considering the home, office, or clinic environment, instruct patients to cover their mouths and noses with fresh disposable tissues when coughing or sneezing to reduce dispersal of infectious material. The rapid identification of potentially infectious individuals through triage and physical separation from other patients and staff will reduce the communicable potential of these patients.[1] (Level ML)

Shielding Yourself and Your Patients

To defend yourself against potentially infectious material, you'll need a variety of barriers and personal protective equipment. A barrier is a material object designed to physically separate the user from a hazard. PPE is specialized clothing or equipment designed to protect the wearer from a hazard, either toxic or infectious.

Examples of PPE and barriers include:[6]

- Gloves
- Protective clothing, such as gowns, aprons, and laboratory coats
- Masks
- Eye protectors
- Face shields
- Head covers
- Shoe covers
- Specialized surgical skin coverings and wound dressings

Before you choose the items you'll need, you must first anticipate the risk. In each and every situation, ask yourself whether there could be blood or body fluid splash, contact with minimal bleeding or drainage, contact with major bleeding or drainage, or exposure to respiratory droplets. Choosing what to wear is based on your assessment.

Let's start with gloves. Standard precautions dictate the use of gloves whenever contact with blood or body fluids is anticipated. Use them whenever touching or examining moist areas of the body, especially wounds and areas of skin that are weeping or draining, or when hand contamination of any type is anticipated. Typically, gloves for patient examination are made from latex rubber, vinyl, or nitrile. If either the wearer or the patient is allergic to latex rubber, then vinyl or nitrile gloves should be used. Most examination gloves are powder free and come in several sizes to accommodate the wearer. Exam gloves are single use and should not be worn for multiple patients or washed. They also should not be worn outside of the immediate patient care area such as in hallways and elevators. Gloves should be removed carefully to avoid contamination with the used surface. Hand hygiene should be performed before donning

gloves and after doffing gloves. Gloves should be readily available at all sites of patient care.

Sterile gloves must be worn for invasive procedures. In addition to protecting the healthcare worker, sterile gloves are used to prevent contamination from personnel to patient during a variety of procedures. As with exam gloves, hand hygiene needs to occur before donning and after doffing, and removal of the gloves needs to be careful and deliberate to prevent inadvertent contamination. Thick utility gloves are called for in the case of environmental cleanup or decontamination procedures. While the wearer won't have exceptional tactile sensation with these, they are less likely to be punctured or torn than latex, vinyl, or nitrile varieties. These gloves should be replaced immediately if they become torn or punctured.

Next, consider whether a gown is necessary. Gowns, aprons, and lab coats offer protection from contamination of skin and clothing by secretions and splattered blood or body fluids. Permeable cloth coats and gowns are suitable for patient contact or laboratory procedures where contamination will probably be light and penetration of the garment by contaminated fluids is unlikely. Fluid-resistant gowns or aprons offer a greater degree of protection if soiling is likely to be heavier. If heavy soiling should occur, the wearer must be able to promptly remove the soiled garment before penetration by contaminated fluid occurs. Impervious gowns and aprons tend to be heavier and more uncomfortable but offer secure protection from heavy soiling by contaminated fluids as could occur during bloody surgical procedures or autopsies. These items are not always one-size-fits-all, so consideration needs to be taken for the amount of coverage provided and the amount of coverage needed. Disposable gowns and aprons should not be re-used for the same patient or for different patients even if they are believed to be clean. It is also important to remove gowns and aprons carefully to prevent exposure to any contamination, visible or not, that may be on the external surface of the garment. For best coverage, the garments should be fastened or tied according to the design.

Then, we have masks. Surgical masks protect the wearer from liquid droplets and fluid splatters and are typically used during surgery, invasive procedures, intubation, and bronchoscopy for the safety of both patient and healthcare worker. Surgical masks and procedure masks are single use and need to be used appropriately for them to provide protection. For masks that have strings, both sets need to be fastened so that mask securely covers the mouth and nose without excess air coming in through the top, bottom, or sides. To preclude the protective surface of the mask from being contaminated by anything in the environment, the mask should not be worn around the neck for future use. Some procedure masks have elastic loops that fit around the ears. The wire along the top of the mask should be formed over the nasal bridge to offer better coverage.
For protection from very small (less than 5 microns) airborne droplet nuclei that can pass through or around most masks, specifically with patients having or suspected of having pulmonary TB, N95 particulate respirators must comply with OSHA regulations. These are tight-fitting masks that do not permit the flow of air around the mask during inhalation and are capable of removing 0.3 micron particulate matter from the inspired air with 95% efficiency. This type of mask is required when working with patients with TB, and sometimes changing HEPA tent filters, performing diagnostic sputum inductions or bronchoscopy, or administering some

aerosolized medications. Users of these masks must be trained in their fit and use with their training documented. In some instances, a powered air-purifying respirator is used for this level of respiratory protection when the provider is not able to wear the N95 respirator.

Face shields, including safety glasses or goggles, will protect the mucous membranes of the eyes, nose, and mouth of the user from splattering of blood or contaminated fluids. Use these during any drilling or other procedure where spraying or splattering of contaminated fluids is possible. Regular eyeglasses provide a small amount of eye protection but generally do not keep splashes from the top, bottom, or sides of the glasses.

Head covers serve a dual role of protecting your head from sprayed or splattered fluids and also protect the patient from desquamated cells and hair from the wearer. Head covers are not routinely used in settings outside of the operating room.

Shoe covers and other drapes and covering materials for equipment and environmental surfaces protect these items from contamination resulting from spills and splatters of contaminated material, simplifying subsequent decontamination and cleaning. Shoe covers are not commonly worn in surgery anymore unless significant contamination during the case is expected. An example of this would be a procedure in which significant blood loss is anticipated. If worn, shoe covers should be removed before exiting the environment. Shoe covers are not routinely recommended for other areas of the hospital.

Special sterile skin and wound coverings or dressings may be applied in the context of surgery to prevent contamination of an adjacent fresh surgical incision or to protect a fresh surgical wound from environmental contamination during the early postoperative hours.

OSHA Recommendations on PPE[6]

The personal protective equipment provided to employees must be:

- Appropriate for the task performed
- Effective in preventing the penetration of potentially infectious materials for the duration of the procedure
- Free of charge and available in proper sizes
- Accessible and conveniently located

Facilities should:

- Implement a process for repairing, replacing, and reprocessing protective barriers and clothing
- Implement procedures for proper disposal and decontamination of PPE
- Educate employees on types, selection, use, location, removal, handling, disposal, and decontamination of PPE
- Prohibit washing and decontamination of disposable gloves
- Provide alternatives for employees who are allergic to the gloves normally provided
- Specify methods for decontamination and indications for replacement of utility gloves
- Ensure side shields are provided with glasses that are used for protective eyewear

Educate employees to wear gloves:

- When there is reasonable likelihood of contact with potentially infectious materials
- During all vascular-access procedures
- When there is contact with mucous membranes and nonintact skin
- When contaminated items or surfaces are handled

The Choice Is Yours

The use of barriers should safeguard the health of both the healthcare worker and the patient in all settings. To optimally do so, PPE must fit the user properly and be functionally intact. The user must also be knowledgeable in the proper way to don (put on) and doff (take off) PPE for maximum protection during use and removal. Intactness is ensured by regular inspection to check for holes or puncture sites (gloves, impermeable aprons or gowns), by not exceeding the device's useful life (mask not saturated with moisture), and not attempting to clean or sanitize a single-use implement (gloves).

Barriers can and do become contaminated during normal use. They can cause contamination when the wearer subsequently handles unrelated environmental objects (telephones, charts, another patient's environment) and thus must be removed immediately after the user completes the procedure for which they were worn.

Overuse of barriers and PPE can cause the patient to feel emotionally isolated and healthcare workers inappropriately secure. It also sharply raises the cost of patient care. The indications for PPE and barriers are selected in response to the planned activity. Their use is subject to the same rational patient care principals as any other medical tool.

PART 3 OF 3

The goal of Part 3 is to understand how to maintain a safe environment through disinfection and sterilization techniques and to prevent the spread of infectious and communicable diseases.

Congratulations! You've made your way through the first two parts of this series. Get ready to see how to create a safe environment for yourself and your patients. But first you'll need some basic terminology:[7] (Level ML)

- **Cleaning** is the removal of foreign material from objects.
- **Decontamination** is the process of removing disease-producing microorganisms, rendering objects safe for handling.
- **Disinfection** results in the elimination of many pathogenic microorganisms, with the exception of bacterial endospores.
- **Sterilization** completely destroys all forms of microbial life.

Watchful Is as Watchful Does

Who really wants to handle contaminated equipment? After all, materials that have come into

direct contact with pathogens can result in outbreaks of infection. These outbreaks can occur as a result of inadequate cleaning, disinfection, or sterilization. The reuse of disposable items has been the culprit in some cases, while failure to reprocess equipment between patients is another serious transgression. But contaminated objects can sometimes slip right past us. Take, for example, unsuspected growth of bacteria in disinfecting solutions, in water supply systems for hemodialysis equipment, in detergent holding tanks for automated endoscope-cleaning systems, and in reusable bars of soap.

We must be vigilant in looking for factors that contribute to these slip-ups. Consider the effect of overpacking instrument trays that need to be sterilized or overloading sterilizers that then fail to reach the right temperature or achieve adequate sterilization time.

Let's consider some of the basics. As the name implies, **single-use** materials must be disposed of promptly after one use. If they are soiled or have come in direct contact with a contaminated area or if they are considered sharps (whether contaminated or not), they become **regulated medical waste** and must be placed in an appropriate bag or container labeled "biohazard" and disposed of properly.

Conversely, **reusable devices** are not tossed but do need specific handling once contaminated. Instruments must be placed in covered containers for transport to a dirty utility area for processing. You may be accustomed to presoaking some of these items once they are in the utility area. Keep in mind that while presoaking in sanitizing solution may help in the subsequent cleaning process, the soaking may cause corrosion to delicate devices.

Thorough internal and external cleaning of instruments and devices having direct contact with patient tissues is the critical first step in the processing of reusable devices. The majority of contaminating microorganisms are mechanically removed during this step. In fact, the detergent itself kills many organisms. Don't let your guard down yet, though. Inadequate cleaning may impair the utility of the device and will definitely impair the effectiveness of most subsequent disinfecting procedures.

To Sterilize or Not to Sterilize

As with virtually all decisions we make daily, start with an assessment. Think first about the level of antimicrobial activity needed. Floors and walls need only low-level disinfection, which can be accomplished with an ammonia/detergent combination. Some patient care equipment, such as a stethoscope or glucometer, requires cleaning between uses that can be performed at the location of use. Most commonly, this is achieved by using a disinfecting product approved by the facility. The products are often available as wet wipes that can be used and discarded.[7] Care needs to be taken to follow the instructions for use, especially the dwell time, or time the item needs to stay wet with the product before it is considered disinfected. The size of the item also needs to be taken into consideration as more than one wipe may be required. Always follow the manufacturer's instructions on how to use the cleaning product as well as the equipment manufacturer's instructions on what can be used to safely clean the item you are trying to clean. When it comes to sterilizing operative instruments however, high-level

sterilization is required.
Devices that are likely to come into contact with normally sterile body sites must be sterilized with moist heat (steam) or chemicals (ethylene oxide, hydrogen peroxide).[7] Typically, these methods use chemical or biological indicators to determine whether all microorganisms and spores have been killed.

Instruments used to invade nonsterile body sites (upper respiratory tract, upper and lower GI tracts) or that come in contact with mucous membrane or nonintact skin must undergo high-level disinfection after thorough cleaning if they cannot be sterilized. (Sterilization may cause damage to optics or significantly shorten the device's life span.) This process is expected to kill virtually all organisms, with the possible exception of bacterial or fungal spores. When it comes to which disinfection agent to choose, the processing temperature, and the soaking time, follow the manufacturer's recommendations. Of course, freshness of the disinfecting solutions and cleanliness of containers and support equipment are vital to avoid cross-infection and contamination.

When devices come in contact with intact skin, they need to be cleaned with a detergent/antimicrobial solution capable of killing vegetative bacteria, pseudomonas, and viruses, including hepatitis B. Here you can choose solutions of aldehydes, phenolics, or halogens combined with detergent based on what is approved by your facility. Again, follow any and all manufacturer's recommendations, which will minimize corrosion or other damage to materials in the device.

Some equipment manufacturers recommend automated disinfection of some products, such as endoscopes. This technique offers the advantage of consistency and relatively unattended processing and minimizes the need for personnel expertise and time. However, quality control issues arise, such as detecting outdated or contaminated disinfecting solutions, maintaining machinery, and ensuring that items have been disinfected as represented.

Potential Reprocessing Problems

Disease can and has been transmitted when any phase of the reprocessing cycle is inadequate. Factors that contribute to the spread of disease include:

- Failure to reprocess or dispose of items between patients
- Inadequate cleaning, disinfection, or sterilization
- Contamination of disinfectant or rinse solutions
- Improper packaging, storage, and handling
- Inadequate/inaccurate record keeping of reprocessing requirements

Other factors that can contribute to contamination include the frequency of hand contact with the instrument, equipment, or environmental surface. Features inherent in the device, such as the configuration and composition, as well as the number of lumens and the presence of hinges and crevices, can also influence contamination.

Keeping Clean Items Clean

Now your equipment is disinfected. What next? These items must be covered or wrapped and stored in a clean, dry place with the date of reprocessing clearly marked. Look for your written policy that determines rotation of stock, acceptable shelf life, and events that would invalidate the disinfection, such as disruption of or water damage to the wrapping. This goes for prepackaged sterile items as well. Periodic culturing of disinfected devices should be done in some circumstances to ensure the process has been effective and contamination has not occurred.

All medical and surgical procedures deserve periodic evaluation from the infection control standpoint. You have to ask some questions. Consider the efficacy and appropriateness of disposal of single-use devices and materials. Find out whether reusable devices like blood pressure cuffs, electronic thermometers, and stethoscopes are being reprocessed appropriately. Are environmental surfaces such as examination tables covered and cleaned consistently? Look for ways that cross-contamination could occur.

If disposable equipment or devices are being reused, will reprocessing effectively disinfect without impairing function or reliability? Departure from the manufacturer's recommendations is not prohibited. However, a protocol must exist governing how preservation of function and verification of disinfection will be monitored. Satisfactory adherence to the protocol is demonstrated via the use of a logbook. Generally speaking, this type of departure from manufacturer's recommendations is costly and carries a risk of liability.

Caring for the Caregiver

To protect healthcare workers from communicable diseases, we have to employ *occupational health strategies.* As applied to infection control, this is a set of activities intended to assess, prevent, and control transmission. To do so, we rely on pre-employment and periodic health assessments to reveal the presence of infective illness. The Joint Commission mandates that screening for exposure or immunity to infectious diseases be available for licensed independent practitioners, staff members, students, and volunteers who may be exposed during their work.[3] Additionally, referral for assessment, potential testing, immunization or prophylaxis/treatment, and counseling for those people identified as potentially having an infectious disease or risk of an infectious disease must be obtainable.

Through serologic screening and immunization programs, healthcare workers susceptible to or infected with rubella, rubeola, varicella, hepatitis B, TB, and influenza are identified. Remember, state law may require healthcare workers be immune to rubella and rubeola. This may not be true of varicella, hepatitis B, or influenza. But susceptibility to these illnesses has implications regarding the type of patients who can be assigned to these healthcare workers. Immunization against hepatitis B is strongly recommended, although not mandated. However, the employer must make the hepatitis B vaccine available to healthcare workers at no cost. Immunization of personnel with influenza vaccine, while usually voluntary, appears to provide some protection to patients from influenza infection and is strongly advised by The Joint Commission and the CDC.

Hospitals should develop a comprehensive influenza vaccine program, offering the vaccine on an annual basis to staff as well as patients. Additional immunizations, including a booster for pertussis, also go a long way in protecting caregivers, patients, and the community at large. Many occupational health departments can assist with obtaining titers for immunity to communicable diseases.

Calling in Sick

Everyone gets sick now and then, and healthcare professionals are no exception. In the best interest of everyone, personnel need to be evaluated when they have symptoms of a communicable disease, including fever, cough with or without sputum production, exanthemas, vesicles, skin lesions, weeping dermatitis, draining wounds or sores, or diarrhea. Healthcare workers with certain reportable diseases, such as amebiasis, are not permitted to work, despite familiarity with standard precautions and disease-specific precautions, until shown to be free of the infecting organism. Healthcare workers with any suspected communicable illness should not report to work without first consulting with their provider or occupational health practitioner.

Inevitably, there will be times when personnel are exposed to communicable disease — in or out of the workplace. Following a documented, unprotected exposure of susceptible healthcare workers to TB, varicella, rubella, rubeola, pertussis, mumps, or a number of other communicable illnesses, an evaluation must be done. Look for seroconversion or skin-test conversion as well as the development of clinical manifestations of infection, and document results. Unless immunity can be demonstrated, exposed workers should not have contact with susceptible patients or coworkers once the disease-specific latent period has elapsed. It may become necessary for the employee to take a furlough until it's clear that he or she is noninfectious. Intervention with vaccination or immune globulin, if possible, is appropriate but not required. Prophylactic use of antibiotics following exposure to meningococcal meningitis, for example, should be described in the personnel policy.

When it comes to TB, forget about the obsolete Tine test. It's not considered to be reliable enough and isn't recommended for workplace screening. Surveillance for TB exposure is achieved by the periodic intradermal inoculation of 5 units PPD (Mantoux test). In some instances, the QuantiFERON-TB Gold test, a blood assay, may be performed.[8] The frequency of screening in a healthcare facility should be based on:[8]

- The profile of TB in the community
- The number of patients with infectious TB to whom the healthcare workers in an area or occupational group may be exposed
- Previous documentation of person-to-person transmission of M. tuberculosis and healthcare workers' skin test conversions (if any)

Healthcare workers who are potentially at medium risk for exposure to TB should be tested annually, whereas those who work in settings where there is ongoing transmission of TB may be tested as often as every eight to 10 weeks.[8] (Level ML)

Generally, ad hoc testing in response to a perceived TB exposure should be avoided and a

regular schedule maintained based on assessment of risk.[8 (Level ML)] Occasionally, infection control or department of health representatives would recommend alternative testing schedules when a highly communicable infection is detected.

Conversion of skin-test status to TB is relevant for documentation of exposure, initiation of chemoprophylaxis, and surveillance for clinical infection. Diagnosis, and in some instances merely strong suspicion, of a reportable disease (TB) obligates the treating physician to report the case to the local department of health for follow-up in certain states.

After a Needlestick

The risk of infection with HIV and hepatitis B and C to healthcare workers is explicitly addressed in OSHA regulations. Prevention of hepatitis B is encouraged through serologic testing for susceptibility and use of recombinant hepatitis B vaccine.[6] Made with recombinant-DNA technology, this vaccine is a safe, highly effective vaccine that protects millions of adults and children worldwide. It should be used selectively in susceptible personnel and may be used in concert with hepatitis B hyperimmune globulin prophylactically following parenteral exposure.

Report all needlestick injuries and parenteral exposures to the employer immediately after washing the area.[10] The injured employee is advised to submit to baseline testing for hepatitis B, hepatitis C, and HIV antibodies. Requirements for consent before testing vary from state to state.

Guarantee confidentiality to both the patient and healthcare worker regarding the results of such testing. Additionally, the employee should be advised of the availability of prophylaxis for HIV infection. At present, the CDC recommends post-exposure chemoprophylaxis with medications consisting of at least three antiretroviral drugs. The CDC endorses a clinical resource hotline specifically for occupational exposures which can be reached at (888) 448-4911 or via http://nccc.ucsf.edu/clinician-consultation/pep-post-exposure-prophylaxis/. Exposure to fluids such as urine, sweat, or saliva doesn't warrant prophylaxis unless those fluids are visibly contaminated with blood.

In recommending chemoprophylaxis, the degree of risk for contracting an HIV infection should be assessed. The highest risk results from a deeply penetrating puncture wound or laceration where blood from the source patient is deposited in tissues or the sharp causing the injury is visibly bloody from the source patient. When the sharp is not visibly soiled with blood, there is an intermediate degree of risk. Contamination of mucous membranes with blood and extended contact of skin with blood from a source patient also pose an intermediate risk of infection. The average risk for HIV transmission after a percutaneous exposure to HIV-infected blood is about 0.3%.[10] In other words, 99.7% of needlestick/cut exposures don't lead to infection. The average risk after a mucous membrane exposure (i.e., eyes, nose, or mouth) is 0.1% (or 1 in 1,000).[10] The risk after exposure of nonintact skin to HIV-infected blood is estimated to be less than 0.1%.[10]

When the Employee Is the Source

When a healthcare worker exposes a patient to a bloodborne pathogen, serologic testing (or other testing method such as polymerase chain reaction, provided a suitable level of reliability can be demonstrated) should be requested of both the worker and patient, with necessary consents, pre- and post-test counseling, and safeguarding of confidentiality. Ethics dictate that patients be advised when exposed to a bloodborne pathogen from a healthcare worker. That patient is entitled to know the nature of the exposure and should have the reason for the exposure explained. If infection is documented, make arrangements for ongoing surveillance of the patient and healthcare worker and for therapeutic intervention. The identity of the source healthcare worker and that person's serologic status to hepatitis B and C and HIV may not be disclosed without that person's consent.

The results of exposed healthcare worker testing must be confidential and may not be the basis for a job action, such as termination, demotion, or even promotion. However, the nature of that person's practice with respect to invasive procedures, the technique for performing them, and the perceived risk to patients may be evaluated in the context of that person's serologic and health status. Compliance with infection control standards is expected.

The presence of weeping dermatitis or skin lesions that may increase the risk of cross-contamination should influence binding recommendations affecting invasive procedures that worker is permitted to perform. Similarly, that worker's overall health status, immunological well-being, and cognitive function affect what duties that person is permitted to perform. Healthcare institutions should assemble an expert panel to evaluate healthcare workers infected with bloodborne pathogens and make binding recommendations regarding continued ability to work in their usual capacity. Consistent with federal disability statutes, any recommendation should seek to impose the least restrictive alternative. The healthcare worker may seek a second opinion from the department of health. An employer without the resources to do this should consult with the department of health regarding an infected or ill employee.

Keeping Your Professional Record Clean

Don't find yourself in trouble with your professional board. Failure to follow these guidelines could add up to professional misconduct.

- Wear gloves when touching body fluids or secretions, mucous membranes, nonintact skin, items soiled by blood or body fluids, contaminated surfaces, and sterile body areas and also during instrument cleaning.
- Discard used gloves following patient care. Change to new gloves when the old ones are torn or damaged. Wash hands and don new gloves before the next patient, and wash hands and other skin surfaces immediately if contaminated with blood or body fluids.
- Wear masks, gowns, or aprons, and protective eyewear or chin-length plastic face shields whenever spattering of blood or other body fluids is likely to occur.
- Sterilize devices that enter the patient's vascular system or other normally sterile areas. Sterilize equipment that touches intact mucous membranes but does not penetrate the patient's body. Use high-level disinfection for devices that cannot be sterilized.

- Monitor the performance of all personnel, licensed or unlicensed, for whom the licensee is responsible regarding infection control techniques.
- Place disposable sharps in puncture-resistant containers for disposal, and place reusable sharp instruments in puncture-resistant containers until cleaned and sterilized.
- Place all specimens of blood and body fluids in containers with secure lids, and clean any spill of blood or other body fluid with an appropriate chemical germicide.
- Maintain ventilation devices to minimize the need for emergency mouth-to-mouth resuscitation.
- Don't perform direct patient care or handle equipment when you have exudative lesions and the condition has not been medically evaluated and determined to be safe or capable of being safely protected against.

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