Infection Prevention for Healthcare Professionals

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Terminology

Alcohol-Based Hand Rub: An alcohol-containing preparation designed for application to the hands to reduce the number of viable microorganisms on the hands. Such preparations in the United States usually contain between 60% to 90% ethanol or isopropanol.

Antimicrobial Soap: A soap or detergent that contains an antiseptic agent.

Antiseptic Agent: Antimicrobial substances that are applied to the skin to reduce the number of microbial flora. Examples of antiseptic agents include alcohol, chlorhexidine, chlorine, hexachlorophene, iodine, chloroxylenol (PCMX), quaternary ammonium compounds, and triclosan.

Barrier: A material object that separates a person from a hazard.

Biofilm: Is created when microorganisms attach to a surface and develop resistance to infection control practices.

Cell-mediated Immunity: Acquired immunity in which the role of T lymphocytes is predominant.

Cleaning: The removal of all foreign material (soil, organic debris) from objects by using water and detergents / soap and washing and scrubbing the object.

Colonization: Is the presence of a micro-organism on / in a host, with growth and multiplication of the organism. However, there is no interaction between the host and the micro-organism, and thus there are no clinical signs and symptoms of the disease.

Common Vehicle: Contaminated material, product, or substance that serves as an intermediate means by which an infectious agent is transported to two or more susceptible hosts.

Communicable Disease: An illness due to a specific infectious agent or its toxic products that arises through transmission of that agent from an infected person, animal, or inanimate source to a susceptible host.

Contamination: The presence of microorganisms on an item or surface.

Critical Device: An item that enters sterile tissue or the vascular system, and must be sterile prior to contact with tissue. A semi critical device is an item that comes in contact with mucous membranes or non intact skin and minimally requires high level disinfection. A non critical device is an item that contacts intact skin but not mucous membranes. It requires low level disinfection.

Cumulative Effect: A progressive decrease in the numbers of microorganisms recovered after repeated applications of a test material.

Decontamination: The use of physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on the surface or item to the point where they are no longer capable of transmitting infectious particles.

Decontaminate Hands: To reduce the bacterial counts on hands by performing antiseptic hand rub or antiseptic handwash.

Detergent: Compounds that possess a cleaning action. They are composed of both hydrophilic and lipophilic parts and can be divided into four groups: anionic, cationic, amphoteric, and nonionic detergents. Although products used for handwashing or antiseptic handwashing in healthcare settings represent various kinds of detergents, the CDC uses the term "soap" to refer to such detergents in its guidelines.

Disinfection: The use of a chemical procedure that eliminates all recognized pathogenic micro-organisms but not necessarily all microbial forms (such as bacterial endospores) on inanimate objects.

Engineering Controls: Controls that isolate or remove the bloodborne pathogens hazard from the workplace. Examples include sharps disposal containers, self-sheathing needles, safer medical devices, such as sharps with engineered sharps injury protections and needleless systems.

Fomites: An inanimate object or material on which disease-producing agents may be conveyed.

Hand Antisepsis: Refers to either antiseptic handwash or antiseptic hand rub.

Hand Hygiene: A general term that applies to either handwashing, antiseptic handwash, antiseptic hand rub, or surgical hand antisepsis.

Handwashing: Washing hands with plain (non-antimicrobial) soap and water.

Healthcare Associated Infection (HAI): A localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent(s) or its toxin(s). There must be no evidence that the infection was present or incubating at the time of admission to the acute care setting; formerly known as nosocomial infections.

- **High-Level Disinfection:** Disinfection that kills all organisms, except high levels of bacterial spores, and is effected with a chemical germicide cleared for marketing as a sterilant by the U.S. Food and Drug Administration (FDA).
- **Intermediate-Level Disinfection:** Disinfection that kills mycobacteria, most viruses, and bacteria with a chemical germicide registered as a "tuberculocide" by the U.S. Environmental Protection Agency (EPA).
- **Low-Level Disinfection:** Disinfection that kills some viruses and bacteria with a chemical germicide registered as a hospital disinfectant by the EPA.

Hospital Acquired Infections (HAIs): Infections associated with healthcare delivery in any setting.

Humoral Immunity: Acquired immunity in which the role of circulating antibodies is most important.

Infection: An infection is the detrimental colonization of a host organism by a foreign species. In an infection, the infecting organism seeks to utilize the host's resources to multiply, usually at the expense of the host. The infecting organism, or pathogen, interferes with the normal functioning of the host . An infection however, is not synonymous with an infectious disease, as an infection may not cause important clinical symptoms or impair host function.

Infectious Disease: A clinically manifest disease of humans or animals resulting from an infection.

Infectivity: The ability of a pathogen to spread rapidly from one host to another.

Injection Safety: Injection safety (or safe injection practices): A set of measures taken to perform injections in an optimally safe manner for patients, healthcare personnel, and others. A safe injection does not harm the recipient, does not expose the provider to any avoidable risks and does not result in waste that is dangerous for the community. Injection safety includes practices intended to prevent transmission of bloodborne pathogens between one patient and another, or between a healthcare worker and a patient, and also to prevent harms such as needlestick injuries.

Multi-dose Medication Vial: Bottle of liquid medication that contains more than one dose of medication and is often used by diabetic patients or for vaccinations.

Occupational Health Strategies: As applied to infection prevention, a set of activities intended to assess and prevent infections and communicable diseases in healthcare workers.

Pathogen or Infectious Agent: A biological agent capable of causing disease.

Pathogenicity: The ability of a pathogen to spread rapidly from one host to another.

Persistent Activity: Prolonged or extended antimicrobial activity that prevents or inhibits the proliferation or survival of microorganisms after application of a product to the hands. This property is also called "residual activity."

Personal Protective Equipment (PPE): Specialized clothing or equipment worn by healthcare workers for protection against a hazard.

Plain Soap: Detergents that do not contain antimicrobial agents or contain low concentrations of antimicrobial agents that are effective solely as preservatives.

Portal of Entry: The means by which an infectious agent enters the susceptible host.

Portal of Exit: The path by which an infectious agent leaves the reservoir.

Reservoir: Place in which an infectious agent can survive but may or may not multiply or cause disease. Healthcare workers may be a reservoir for a number of nosocomial organisms spread in healthcare settings.

Single-Use Medication Vial: A bottle of liquid medication that contains more than one dose of medication, and is often used by diabetic patients or for vaccinations.

Susceptible host: A person or animal not possessing sufficient resistance to a particular infectious agent to prevent contracting infection or disease when exposed to the agent.

Standard precautions: A group of infection prevention and control measures that combine the major features of Universal Precautions and Body Substance Isolation and are based on the principle that all blood, body fluids, secretions, excretions except sweat, non-intact skin, and mucous membranes may contain transmissible infectious agents.

Sterilization: The use of a physical or chemical procedure to destroy all microbial life, including highly resistant bacterial endospores.

Substantivity: An attribute of certain active ingredients to adhere to the stratum corneum and remain on the skin after rinsing or drying to provide an inhibitory effect on the growth of bacteria remaining on the skin.

Susceptible Host: A person or animal lacking effective resistance to a particular infectious agent.

Surgical Hand Antisepsis: Antiseptic handwash or antiseptic hand rub performed preoperatively by surgical personnel to eliminate transient and reduce resident hand flora. Antiseptic detergent preparations often have persistent antimicrobial activity.

Transmission: Any mechanism by which a pathogen is spread by a source or reservoir to a person.

Virulence: The ability of a pathogenic agent to produce a disease. The capacity of a microorganism to cause disease.

Visibly Soiled Hands: Hands showing visible dirt or visibly contaminated with proteinaceous material, blood, or other body fluids, urine, or fecal material.

Work Practice Controls: Controls that reduce or eliminate the likelihood of exposure by altering the manner in which a task is performed.

Purpose and Objectives

The purpose of this self-study course is to provide healthcare professionals with information so they are able to proficiently apply general principles of infection prevention and reduce transmission of pathogens.

After successful completion of this course, you will be able to:

1. Identify the professional's responsibility to monitor infection prevention practices.
2. Describe how pathogens are spread and discuss strategies for preventing transmission of these organisms.
3. Describe how infection prevention concepts are applied in professional practice.
4. Define "engineering controls" and "work-practice controls" and describe the causes of most common needlestick injuries.
5. Identify isolation precautions and discuss the use of personal protective equipment (PPE).
6. Discuss handwashing options for healthcare professionals (HCPs).
7. Identify strategies for effective pre-cleaning, chemical disinfection, and sterilization of instruments and devices.
8. Identify occupational health strategies for preventing communicable diseases in healthcare workers, and discuss resources available for evaluation of healthcare workers infected with HIV, HBV, and HCV.

Introduction

Infection prevention practices help form the backbone of nursing and healthcare professional practice.

Every day healthcare professionals follow procedures to protect themselves, their patients, and the public from infectious disease by washing their hands, using aseptic techniques, following detailed isolation procedures, reprocessing patient-care equipment, and overseeing the infection prevention practices of the people they supervise.

Healthcare professionals also teach patients and their visitors to follow infection prevention practices during a patient's hospitalization and to continue these practices after discharge.

These routine practices help fight a growing number of infectious diseases and can aid in controlling the dramatic rise of antibiotic-resistant organisms. Yet, despite these efforts, hospital-acquired infections continue to spread.

Statistics

Healthcare associated infections (HAIs) are now the fourth leading cause of death in America. Each year, hospital-acquired infections kill over 100,000 patients. Proper handwashing alone could save up to 20,000 patients each year. According to the National Healthcare Safety Network (NHSN) Surveillance System report, the following are the most common sources of hospital-acquired infections (Office of the Director Report, October 15, 2009):

Estimates of Healthcare-associated Infections in US Hospitals Annually

	Number of Infections	National Cost Billion $	Deaths
Device-related infections			
Urinary tract infections	560,000	0.4-0.5	8,000
Bloodstream infections	250,000	2-8	31,000
Pneumonia	250,000	5-7	36,000
Procedure-related infections			
Surgical site infections	290,000	3-8	13,000

CDC, 2010

Infection Prevention Guidelines: FAQs

Why should I follow infection prevention practices?

Infection prevention is an important and strategic part of your professional responsibilities. Infection prevention practices promote health and can limit disease for you, your patients, and the general public. Failure to apply scientifically accepted principles and practices of infection prevention could lead to illness and even result in charges of professional misconduct.

Can a Registered Nurse be disciplined if other healthcare professionals being supervised by the nurse fail to follow infection prevention standards?
Nurse Practice Acts generally holds the Registered Nurse responsible for overseeing the care of those that they supervise. Therefore, you are responsible for other healthcare practitioners who you supervise.

Who else am I responsible for monitoring?
You are responsible for monitoring the infection prevention practices of other people involved in the care of your patients. You are also responsible for teaching visitors and family members to comply with infection prevention practices and to monitor their practices. Patients should be protected by routine infection prevention practices that will keep their environment and the equipment they need safe.

For example, if your patient is in isolation, you must monitor everyone who enters the room to insure that they take the correct precautions. Teach them how to comply with infection prevention practices, and follow your hospital's policies for reporting or disciplining employees who fail to follow the appropriate infection prevention practices.

Infection Prevention Standards & Guidelines

The Centers for Disease Control and Prevention (CDC) has published guidelines and recommendations for the prevention of various healthcare associated infections. These guidelines are sorted by practices that protect patients, protect healthcare workers, and by assorted topics.

They include (CDC, 2013b):

- Guideline for Prevention of Catheter Associated Urinary Tract Infections (http://www.cdc.gov/HAI/index.html)
- 2011 Guidelines for the Prevention of Intravascular Catheter-Related Infections (http://www.cdc.gov/hicpac/BSI/BSI-guidelines-2011.html)
- 2008 Guideline for Disinfection and Sterilization in Healthcare Facilities (http://www.cdc.gov/hicpac/Disinfection_Sterilization/acknowledg.html)
- Tools for Protecting Healthcare Personnel (http://www.cdc.gov/HAI/prevent/ppe.html)
- Hand Hygiene in Healthcare Settings (http://www.cdc.gov/handhygiene/)

Always follow your hospital's policies and procedures to guide your infection prevention practices.

Chain of Infection

Infection prevention practices are based on a circular "chain of infection." The six links in the chain are:

- Reservoir
- Escape
- Transmission
- Entry
- Susceptible host
- Disease agent

Each chain requires nursing assessments and interventions to break the process of infection. Healthcare professionals can enter this circular chain at any link.
As the saying goes; "A chain is only as strong as its weakest link."

This self-study course examines each link and will help you apply scientific principles to help keep you and your patients safe and healthy.

True or False?

Effective infection prevention strategies can prevent disease transmission by interrupting one or more links in the chain of infection.

TRUE!

The Reservoir

A reservoir is a place where infectious agents find it favorable to live and multiply. A reservoir could be a person, animal, arthropod, plant, soil, or another substance where infectious agents thrive and reproduce. Bacteria and other infectious agents depend on reservoirs for their survival, and they can be transmitted from reservoirs to susceptible hosts. In hospitals, reservoirs can be patients, hospital workers, visitors, equipment, food, or the hospital itself, the building, water supply, or ventilation system.

Although patients may be hospitalized to receive treatment for infectious diseases, they may also become infected while hospitalized, or they may be chronically infected. It is not unusual for a patient to be unaware that they are chronically infected with a virus such as herpes simplex virus (HSV), human papilloma virus (HPV), human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), or other pathogens.

Test Yourself

In hospitals, reservoirs can be:

a) Patients
b) Hospital workers
c) The ventilation system
d) All of the above

Pathogens

A few of the pathogens that might infect your patients include:

- **Bacteria:** Pseudomonas aeruginosa, Mycobacterium tuberculosis (MTB), acinetobacter, clostridium difficile (C. Diff), Streptococcus pneumoniae, Staphylococcus aureus, Methicillin-resistant Staphylococcus Aureus (MRSA), Vancomycin Resistant Enterococci (VRE),
- **Viruses:** Hepatitis Simplex Virus (HSV), Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), mumps, norovirus
- **Fungi:** Cryptococcus neoformans, Candida, Histoplasma capsulatum
- **Parasites:** Entamoeba histolytica, Giardia lamblia

The Escape: How Pathogens Leave the Reservoir

To infect a new susceptible host, pathogens must leave an already infected person through portals of exit specific to the kind of pathogen. For example, HIV can easily exit through the portals of blood, semen, cerebral spinal fluid, amniotic fluid, and fluids that surround organs or joints. However, HIV cannot exit through a cough, sneeze, stool, urine, or tears.

Other organisms; such as the influenza virus, exit through droplet nuclei when patients sneeze, cough, or spit. Intestinal parasites can exit in stool, and organisms, such as *cytomegalovirus* (CMV) can easily exit in urine. Isolation precautions are based in part on the organism's portals of exit.

True or False?

HIV can exit the host in a cough, sneeze, stool, urine, or tears.

False.

HIV can easily exit through the portals of blood, semen, cerebral spinal fluid, amniotic fluid, and fluids that surround organs or joints.

Modes of Transmission

Each pathogen can be moved from a reservoir to a susceptible host by:

- Direct contact
- Indirect contact
- Droplet spread
- Aerosolized in the air
- Common vehicle
- By a vector (for example mosquitoes, ticks, etc)

Entry Modes

Organisms can enter the body through mucous membranes, broken skin, the gastrointestinal tract, the respiratory tract, or the genitourinary tract. Exposure to healthcare procedures can offer many opportunities for organisms to enter a person's body by breaching natural protective barriers. Surgery or intravenous catheters break normally intact skin and provide direct access to the blood stream. Urinary catheterization puts a foreign object into a normally sterile body cavity. Intubation and endotracheal suctioning bypass protective barriers in the upper respiratory tract.

What's missing from the image?

PPE's! Personal protective equipment such as gloves and face shield.

The Susceptible Host

Even if you have been exposed to infectious disease, it doesn't mean you will necessarily become infected. Microorganisms can colonize a host but not actually interfere with the normal functioning of the host. When this occurs, the microorganisms lay dormant and do not cause any clinical signs or symptoms of infection or disease.

Infection may occur when the colonization of micro-organisms becomes detrimental to the host, by interfering with the functioning of the host. When this occurs, clinical signs and symptoms of disease may become apparent in the host.

The appropriate treatment of a particular individual may depend on whether the pathogen has simply colonized the person or caused infection.

Most healthy individuals have natural barriers that help prevent potentially infectious organisms from getting a foothold. Intact skin prevents many organisms from entering, gastric acid kills many organisms, cilia in the respiratory tract sweep organisms up so they can be expelled and tears wash the eyes.

Hospitalized patients, however, are at increased risk for infections because their immune systems might already be compromised. In addition, many treatments and procedures can undermine patients' natural barriers against infection.

The immune system fights invading organisms through the inflammatory response, antibodies, and cell-mediated immunity.

Individuals that may be at an even greater risk of infection because of weakness in their immune systems include:

- Infants
- Elderly
- Patients taking steroids or immune-modulating medications
- People infected with HIV
- People with cancer or receiving chemotherapy or radiation treatment
- People with end-stage renal disease
- People with diabetes mellitus

More Info

Colonization is the presence of micro-organisms in a host *without* clinical signs or symptoms of infection.

Infection is the detrimental colonization of the host *with* clinical signs and symptoms of infection.

The Disease Agent

Some organisms cause disease more easily than others. For example, HBV is easier to contract than HIV.

The number of organisms you are exposed to also increases the likelihood of infection. For example, MTB is less likely to cause infection when ample amounts of fresh air dilute the number of organisms in the air a person breathes.

Similarly, a needlestick injury that injects several mL of a patient's blood into a nurse is more likely to lead to infection with bloodborne organisms (such as HIV, HBV, or HCV) than is an injury with a blunt needle without visible blood.

The number of exposures can make a difference. Injection drug users, for example, increase their risk of infection with HIV or HCV when they share injection equipment; especially with a large number of partners.

Spread of Pathogens in the Absence of Infectious Disease

If patients haven't been diagnosed with infectious diseases and don't have draining wounds, how can pathogens spread?

Patients' skin may be colonized with pathogens. For example, patients with diabetes, chronic dermatitis, and chronic renal failure treated with dialysis are more likely to be colonized with *S. aureus.*

Since patients, regardless of their diagnoses, shed skin cells carrying microbes, healthcare professionals can pick up microorganisms from a patient's intact skin, gown, bed linens, bedside furniture, and other objects and medical equipment in the patient's immediate environment.

Frequently the patient’s environment is contaminated with bacteria, such as staphylococci or enterococci that survive despite drying (CDC, 2002).

Preventing Transmission

When providing care to your patients, it is advisable to consider that all your patients are potentially infected with bloodborne pathogens.

Protect yourself and your patients by following standard precautions, including wearing gloves and other protective equipment whenever exposure is anticipated. Assess patients for signs of infection. Infectious patients should be identified quickly and treated appropriately. Transmission-based precautions include contact, droplet, and airborne precautions.

In addition, prevention can be accomplished by washing your hands, wearing gloves, and using other barriers when needed. Use only sterilized or properly disinfected supplies and equipment and dispose of the supplies and equipment following facility policies and procedures. Implement and support environmental control

measures, such as housekeeping, proper ventilation, waste disposal, and laundry.

Vaccinations

Vaccination can protect you and your patients, and is one way of preventing the spread of pathogens.

Hepatitis B vaccine safely and effectively prevents HBV infections for most people.

Post-exposure prophylaxis helps prevent some infections including HBV, HIV, and meningococcal meningitis.

For additional information on vaccinations for healthcare professionals, visit the CDC's site at:
http://www.cdc.gov/vaccines/spec-grps/hcw.htm

Standard Precautions

Standard precautions have essentially replaced universal precautions. Standard precautions apply to all patients and are intended to reduce the risk of transmission of microorganisms whether they are recognized or not.

Standard precautions apply to all patient encounters involving blood; all body fluids, except sweat, regardless of the presence of visible blood; non-intact skin; and mucous membranes. The healthcare professional must select appropriate PPE in anticipation of nursing activities or interventions.

Consider all patients to be potentially infected with bloodborne pathogens, and protect yourself and your patients by following standard precautions, including wearing personal protective equipment (PPE) whenever exposure is anticipated.

More Info

Elements of Standard Precautions:

- **Handwashing**
- **Use of gloves, masks, eye protection, and gowns**
- **Patient care equipment**
- **Environmental surfaces**
- **Injury prevention**
- **Standard precautions apply to all patients**

(CDC, 2003)

Hand Hygiene

Hand hygiene has been cited frequently as the single most important practice to reduce the transmission of infectious agents in healthcare settings and is an essential element of Standard Precautions.

The term “hand hygiene” includes both handwashing with either plain or antiseptic-containing soap and water, and use of alcohol-based products (gels, rinses, foams) that do not require the use of water.

In the absence of visible soiling of hands, approved alcohol-based products for hand disinfection are preferred over antimicrobial or plain soap and water because of their superior microbicidal activity, reduced drying of the skin, and convenience.

Hand Hygiene: Artificial Nails & Jewelry

The effectiveness of hand hygiene can be reduced by the type and length of fingernails. Individuals wearing artificial nails have been shown to harbor more pathogenic organisms, especially gram negative bacilli and yeasts.

In 2002, CDC/HICPAC recommended that artificial fingernails and extenders not be worn by healthcare personnel who have contact with high-risk patients (e.g., those in ICUs, ORs) due to the association with outbreaks of gram-negative bacillus and candidal infections as confirmed by molecular typing of isolates.

At this time such decisions are at the discretion of an individual facility's infection control program.

There is less evidence that jewelry affects the quality of hand hygiene. Although hand contamination with potential pathogens is increased with ring-wearing, no studies have related this practice to healthcare worker-to-patient transmission of pathogens (CDC, 2008).

The Importance of Handwashing

Pathogens on the hands of healthcare workers can be easily spread from one patient to another or from patients to other healthcare workers. This can lead to deadly infections.

Proper antiseptic handwashing or alcohol-based hand rubs could save as many as 20,000 patients each year who die from healthcare associated infections (HAIs) (Berens, 2002).

Handwashing and Gloves

If I wash my hands, do I still need to wear gloves?

Gloves don't eliminate the need for hand hygiene. Likewise, the use of hand hygiene does not eliminate the need for gloves.

Gloves reduce hand contamination by 70% to 80%, help to prevent cross-contamination, and help to protect patients and healthcare personnel from infection (CDC, 2002).

Handwashing: Soap Versus Alcohol Rubs

When should I wash my hands with soap and water or use alcohol-based hand rubs?

According to CDC guidelines, you should wash your hands with soap and water or use alcohol based hand rubs at the following times:

- Before having direct contact with patients.
- Before donning sterile gloves to insert a central intravenous catheter.
- Before inserting an indwelling urinary catheter, peripheral vascular catheter, or another invasive device that does not require a surgical procedure.
- After contact with a patient's intact skin, such as taking a pulse, measuring a blood pressure, or lifting.
- After contact with body fluids or excretions, mucous membranes, non-intact skin, and wound dressings if your hands don't become visibly soiled.
- Before moving from a contaminated-body site to a clean-body site during patient care.
- After contact with an inanimate object, such as medical equipment, in the patient's immediate vicinity.
- After removing gloves.

Did You Know

The CDC recommends handwashing with soap and water (rather than alcohol based hand rubs) after contact with a patient with *Clostridium Difficile* (*C. Diff)*.

How to Wash Hands Effectively

How should I clean my hands before and after I eat or after I use the bathroom at work?

Wash your hands with soap and water. First wet your hands. Then apply soap to your hands and rub your hands together vigorously for at least 15 seconds.

Make sure to cover all the surfaces of your hands and fingers with soap and rub them together. Remember to use the amount of soap recommended by the manufacturer.

Rinse your hands with running water, but use warm or tepid water because very hot water can irritate your skin. Dry your hands thoroughly with a disposable towel and use the towel to turn off the faucet (CDC, 2010).

Test Yourself

After applying soap to your hands, how long should you rub your hands together?

a) Five seconds
b) Ten seconds
c) 60 seconds
d) None of the above

Handwashing Options: FAQs

Are there times when I must wash my hands with soap and water?

Yes. The CDC recommends that you wash your hands with soap and water (vs. alcohol based rub) when your hands are visibly soiled with blood, other body fluids, or protein-rich materials (CDC, 2002).

What is the best way to use an alcohol-based hand rub?

Apply an alcohol-based hand rub on the palm of one hand, and then rub your hands together covering all the surfaces of your hands and fingers until your hands are dry. Use the amount of alcohol-based hand rub recommended by the manufacturer (CDC, 2008).

How should I wash my hands if I think I've been exposed to *Bacillus anthracis,* the bacteria that causes anthrax?

Because alcohol and other antiseptic agents don't work well against spores from this type of bacteria, wash your hands with soap and water. Rubbing your hands together under running water helps rinse away the spores (CDC, 2008).

Special Options for Handwashing

My skin is sensitive. What should I do?

Alcohol-based hand rubs might help. Also use hand lotions or creams approved and provided by your employer. For many people, hand rubs cause less skin irritation than traditional soap and water. Although allergic contact dermatitis due to alcohol hand rubs is rare; watch for signs of allergies and consult your hospital's infection prevention department for recommendations for alternative ways to wash your hands (CDC, 2008).

Do I have to cut my fingernails?

The CDC warns that healthcare professionals should avoid wearing artificial nails and to keep your natural nails less than one quarter of an inch long (CDC, 2008). Most healthcare facilities do not permit artificial nails in patient care areas.

What about surgical suites and special care areas?

Surgical suites, special care nurseries, and some other areas call for specific techniques for cleaning your hands and covering your clothes. Follow your hospital's policies and procedures before entering these areas.

Engineering Controls

What are engineering controls?

Engineering controls remove or reduce hazards by the use of specially designed equipment, devices, or instruments. Engineering controls have helped reduce the risks of injuries from needles and other sharp instruments.

What engineering controls have been used to reduce the risks of needlestick injuries?

To reduce the dangers of injury to healthcare workers, engineers have developed new styles of needles—or eliminated the need for needles—in blood collection devices, IV systems, and prefilled medication delivery systems. Puncture resistant containers are used to store sharps or to dispose of them. People who process reusable sharps use puncture-resistant gloves.

Other engineering controls ensure adequate ventilation or prevent transmission of pathogens by maintaining droplet or airborne precautions. HEPA filtration, positive-pressure or negative-pressure ventilation systems, and ultraviolet irradiation also prevent transmission.

Work Practice Controls

What are work practice controls?

Work practice controls mean changing the way you complete a task to reduce or eliminate the likelihood of exposure to pathogens. For example, disposing of used syringes with their needles still attached / uncapped into a puncture-proof container.

Other examples of work practice controls include; to avoid leaving sharps in a patient care area, using forceps or suture holders when suturing, maintaining isolation precautions, using tools rather than your hands to disassemble sharp equipment, properly disposing of body fluids or cleaning spills of body fluids, and using personal protective equipment. Many of the recommendations included in this course involve work practice controls.

Infection Control Program Goals

- Provide a safe working environment
  - Reduce health care-associated infections
  - Reduce occupational exposures

Needlestick Injuries

Most needlestick injuries occur through the incorrect handling, disassembly, disposal and reprocessing of contaminated needles and other sharp objects. Most of these injuries occur after use and before disposal.

Needlestick injuries expose healthcare workers to the risk of occupational exposure to bloodborne pathogens (OSHA, 2010). Bloodborne pathogens are pathogenic microorganisms that are present in human blood and can cause disease in humans.

These pathogens include Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), and others (Occupational Safety and Health Administration [OSHA], 2010).

Risk of Needlestick Injuries

What is my risk of contracting HCV from a single needlestick injury?

The CDC (Centers for Disease Control and Prevention) estimates that each year, health care workers sustain more than 600,000 injuries involving contaminated needles or sharps, and approximately one-half of these injuries go unreported (TJC, 2001).

The risk of infection from a contaminated needlestick or sharp is dependent upon the pathogen involved, the severity of the injury, and the availability and use of appropriate prophylactic treatment.

What can nurses do to reduce their risk of needlestick injuries?

Many hospitals are able to provide safer equipment than what has been used in the past. Safe devices include needleless IV systems, retractable needles, closed blood collection systems, and prefilled syringes. The National Institute for Occupational Safety and Health recommends the following strategies to help prevent needle-stick injuries (TJC, 2001).

- Eliminate needles when safe and effective alternatives are available.
- Use devices with safety features and evaluate their effectiveness.
- Analyze injuries from needles and other sharps to identify hazards.
- Train healthcare workers to safely use and dispose of sharps.
- Modify work practices that put healthcare workers at risk.
- Encourage timely reporting and follow up of all sharps-related injuries.
- Evaluate the effectiveness of prevention practices and provide feedback on performance.
- Stay up to date about risk factors and ways to prevent injuries.
- Encourage all employees to report hazards for sharps-related injuries.
- Encourage vaccination with HBV vaccine.

Needlesticks and other sharps-related exposures are the most common route of HIV transmission in healthcare settings.

Needlestick Injuries & Bloodborne Pathogens

Which needlestick injuries are more likely to result in the injured nurse becoming infected with bloodborne pathogens?

All sharp devices can cause injury and disease transmission if not used and disposed of correctly.

Injury with hollow bore devices carries a higher risk of disease transmission. Devices with butterfly type IV catheters or devices with recoil action have higher injury rates.

According to the National Institute of Occupational Safety, all infections are more likely when:

- The needle or sharp is visibly contaminated with blood.
- The needle had been directly in the patient's vein or artery.
- The injury to the healthcare worker is deep.
- A relatively large amount of blood or infected body fluid is injected into a healthcare worker, or contaminated a healthcare worker's open wounds.
- The patient was terminally ill.

Preventing Needlestick Injuries

What actions should I avoid when dealing with needles and other sharp objects, to prevent a needlestick injury?

- Avoid manipulating needles and sharp instruments by hand, such as removing scalpel blades from holders and needles from syringes.
- Do not delay the disposal of sharp instruments by leaving them on counters / workspaces. Also ensure that they are disposed of correctly, in puncture resistant sharps receptacles.
- Avoid recapping contaminated needles and other sharp objects using a two handed technique.
- Avoid performing procedures where there is poor visualization, such as blind suturing, non-dominant hand opposing or next to a sharp or performing procedures where bone spicules or metal fragments are produced.

What are safe injection practices?

Safe injection practices and procedures prevent disease transmission from patient to healthcare worker, and vise versa.

More Info

Safe Practice includes:

- **Avoid recapping needles.**
- **Pass sharp instruments by use of a designated Safe Zone.**
- **Disassemble sharp equipment by use of forceps or other devices.**

Pathogens, including HCV, HBV and HIV can be present in sufficient quantities to produce infection in the absence of visible blood.

Safe Injection Practices & Procedures

Proper infection control technique requires healthcare providers to maintain aseptic technique throughout all aspects of injection preparation and administration. This includes:

- The use of "clean" medication prep area
- Proper hand hygiene and use of sterile technique in preparing medications
- Discarding expired vials or vials with questionable sterility
- Avoidance of "spiking" (inserting a needle into a vial or IV bag for multiple usages).

Unsafe injection practices may result in one or more of the following:

- Transmission of bloodborne viruses, including hepatitis B (HVB) and hepatitis C (HVC).
- Exposure of thousands of patients to bloodborne pathogens. If this occurs, it is recommended that the

exposed patients be tested immediately for hepatitis B and C, and HIV virus.

- Malpractice suits filed by patients.
- Referral of providers to licensing boards for disciplinary action.

Did You Know

Pathogens including HCV, HBV & HIV can be present in sufficient quantities to produce an infection even in the absence of visible blood. Bacteria and other microbes can also be present without clouding or visible evidence of contamination. Thus all injection supplies and materials that are *potentially* contaminated should be discarded.

Guidelines for Preparing & Administering Injections & Infusions

To avoid potential contamination and infection, all healthcare providers should adhere to the following guidelines when preparing and administering injections and infusions:

- Never administer medications from the same syringe to more than one patient, even if the needle is changed.
- Never use the same syringe or needle to administer IV medications to more than one patient, even if the medication is administered into the IV tubing, regardless of the distance from the IV insertion site.
- Remember that all of the infusion components from the infusate to the patient's catheter are a single interconnected unit, and all of the components that are directly or indirectly exposed to the patient's blood and cannot be used for another patient.
- Syringes and needles that intersect through any port in the IV system also become contaminated and cannot be used for another patient or used to re-enter a non-patient specific multi-dose medication vial.
- Separation from the patient's IV by distance, gravity and/or positive infusion pressure does not ensure that small amounts of blood are not present in these items.
- Never enter a vial with a syringe or needle that has been used for a patient if the same medication vial might be used for another patient.
- Dedicate vials of medication to a single patient, whenever possible, and medications packaged as single-use must never be used for more than one patient.
- Never combine leftover contents for later use; medications packaged as multi-use should be assigned to a single patient whenever possible.
- Never use peripheral capillary blood monitoring devices packaged as single-patient use on more than one patient, and restrict use of peripheral capillary blood sampling devices to individual patients.
- Never reuse lancets. Use single-use lancets that permanently retract upon puncture whenever possible.

Personal Protective Equipment (PPE) and Barriers

What personal protective equipment (PPE) protects nurses from infectious hazards?

Healthcare professionals frequently use a variety of personal protective equipment to make practice safer and to avoid exposure to infectious materials. Personal protective equipment includes sterile or examination gloves, cover gowns, aprons, laboratory coats, masks, fluid shields, safety glasses and goggles.

What are barriers?

Barriers are any object that separates you from a hazard.

Choosing PPE

How do I choose PPE?

To choose the proper equipment, ask yourself the following questions:

- Am I performing a sterile procedure? If so, you must wear sterile gloves instead of examination gloves.
- Am I allergic to latex? If so, then use vinyl or any other recommended type of gloves.
- Are my hands in danger of being cut by contaminated sharps, especially during cleaning instruments or disassembling equipment? If so, then wear stronger gloves reinforced with puncture-resistant material.

- Will blood or other potentially infectious body fluids splash or spray? If so, you need shields to protect your eyes and mouth and gowns to cover your body. You may also need head and shoe covers. If you expect a large volume of blood or drainage, use personal protective equipment that is fluid resistant.
- Will I be exposed to airborne pathogens? If so, you need to wear a N95 or particulate respirator.

Protection from PPE

How do I know that personal protective equipment is still working to protect me?
Only use personal protective equipment that fits properly and is free of holes. Don't use disposable equipment that has been worn by another person and make sure that non-disposable equipment has been properly cleaned and disinfected since its last use.

Can you wear personal protective equipment too long?
Yes. Remember to remove your gloves and wash your hands after caring for a patient, before charting, or touching other environment surfaces or equipment. Avoid cross contaminating patients by not using the same personal protective equipment while caring for more than one patient. Put disposable gloves, gowns, shields and other personal protective equipment in the biohazard trash. Store reusable equipment per equipment instructions and facility policy before it is disinfected.

PPE: Gloves

Gloves are used to prevent contamination of healthcare personnel hands when:

- Anticipating direct contact with blood or body fluids, mucous membranes, non intact skin and other potentially infectious material.
- Having direct contact with patients who are colonized or infected with pathogens transmitted by the contact route e.g., VRE, MRSA, RSV.
- Handling or touching visibly or potentially contaminated patient care equipment and environmental surfaces.

Gloves can protect both patients and healthcare personnel from exposure to infectious material that may be carried on hands (CDC, 2008).

Non-sterile disposable medical gloves made of a variety of materials (e.g., latex, vinyl, nitrile) are available for routine patient care. Latex or nitrile gloves are preferable for clinical procedures that require manual dexterity and/or will involve more than brief patient contact. Heavier, reusable utility gloves are indicated for non-patient care activities, such as handling or cleaning contaminated equipment or surfaces.

Respirators

A respirator is a personal protective device that is worn on the face, covers at least the nose and mouth, and is used to reduce the wearer’s risk of inhaling hazardous airborne particles (including dust particles and infectious agents), gases or vapors.

Air-purifying respirators (APR) include particulate respirators, which filter out airborne particles, and “gas masks,” which filter out chemicals and gases.

The classification of particulate respirators can be subdivided into three categories:

- Particulate filtering facepiece respirators - Sometimes called disposable respirators, are commonly referred to as “N95s.”
- Elastomeric respirators - Sometimes referred to as reusable respirators because the facepiece is cleaned and reused but the filter cartridges are discarded and replaced when they become unsuitable for further use.
- Powered air-purifying respirators (PAPRs) - A battery-powered blower moves the air flow through the filters.

N95 Respirators

What is a NIOSH-Approved N95 Respirator?

N95 respirator is a term used to describe the class of respirators which use N95 filters to remove particles from the air that is breathed through them. The NIOSH term N95 refers to a filter class that removes at least 95% of airborne particles during “worse case” testing. Respirator filters that collect at least 99.97% (essentially 100%) receive a "100" rating.

Respirator filters are also rated as N, R, or P for their level of protection against oil aerosols. This rating is important because some industrial oils can reduce the filter efficiency performance. Respirators are rated "N" if they are not resistant to oil, "R" if somewhat resistant to oil and "P" if strongly resistant (oil proof).

Thus, there are nine types of particulate respirator filters:

- N95, N-99, and N-100
- R-95, R-99, and R-100
- P-95, P-99, and P-100

The overall effectiveness of respiratory protection is affected by the:

- Level of respiratory protection selected (e.g., the assigned protection factor)
- Fit characteristics of the respirator model
- Care in using the respirator
- Adequacy of the training and fit-testing program

The most essential attribute of a respirator is the ability to fit the varying facial sizes and characteristics of health-care workers (HCWs). Assistance with selection of respirators can be done through consultation with respirator fit-testing experts and from participation in advanced respirator training courses.

If respirators are used in a health-care setting, the Occupational Safety and Health Administration (OSHA) require the development, implementation, administration, and periodic reevaluation of a respiratory protection program. The most critical elements of a respiratory protection program include training, and fit testing. All HCWs who use respirators should be included in the respiratory protection program.

Droplet Precautions

Droplet transmission occurs when respiratory droplets carrying infectious pathogens transmit infection from the respiratory tract of the infectious individual to susceptible mucosal surfaces of the recipient, generally over short distances (<3 feet), necessitating facial protection.

The CDC recommends that healthcare workers wear a mask when within 6 to 10 feet of the patient with an airborne infection, especially when exposure to emerging or highly virulent organisms (CDC, 2003).

Preventing the spread of pathogens that are transmitted by the airborne route requires the use of special air handling and ventilation systems to contain and then safely remove the infectious agent; infectious agents (such as Mycobacterium tuberculosis), rubeola virus (measles), and varicella-zoster virus (chickenpox).

In addition to the use of special air handling and ventilation systems, respiratory protection with NIOSH certified N95 or higher level respirator is recommended for HCPs entering a room in which a patient with an airborne infectious disease is being cared for.

For certain other respiratory infectious agents, such as influenza and rhinovirus, and even some gastrointestinal viruses (e.g., norovirus and rotavirus) there is some evidence that the pathogen may be transmitted via small-particle aerosols. Such transmission has occurred over distances longer than 3 feet but within a defined airspace (e.g., patient room), suggesting that it is unlikely that these agents remain viable on air currents that travel long distances.

Consult your hospital's infection preventionist if you question whether a patient needs droplet precautions.

Isolation Precautions: FAQs

How many different kinds of isolation are used in hospitals?

- Airborne precautions
- Droplet precautions
- Contact precautions

What's the difference between airborne precautions and droplet precautions?
The choice of airborne precautions and droplet precautions depends on the size of the particles that must be contained; particles smaller than 5 microns call for airborne precautions, while particles larger than 5 microns require droplet precautions.

What kind of microorganisms must be contained by airborne precautions?
Airborne precautions are designed to prevent transmission of very small particles: either airborne droplet nuclei (less than 5 microns in size) of evaporated droplets that can stay suspended in the air for long periods of time or infectious agents riding in the air on dust particles. Airborne microorganisms eventually cause new infections after being inhaled. Examples of microorganisms that require airborne precautions include measles, varicella, or tuberculosis. Consult your hospital's infection preventionist if you question whether a patient needs airborne precautions.

More Info

Standard precautions are applied to all patient encounters where contact with body fluids is anticipated.

Isolation precautions (contact, airborne and droplet precautions) are employed when dealing with an infectious or communicable disease.

Isolation Precautions: FAQs

How do contact precautions differ from standard precautions?
In both instances you need to wash your hands, wear non-sterile gloves, and protect yourself from splashes. But patients with contact precautions are usually in private rooms, and you need to wear a gown and gloves whenever you enter the room. Patients infected with methicillin resistant *staphylococcus aureus* or vancomycin resistant *enterococci* (VRE) may need additional precautions.

Consult your hospital's infection preventionist for more information.

What do I do if I think a patient needs to be isolated, but the doctor hasn't ordered isolation?
Notify the physician of your findings, provide the appropriate precautions until the patient can be fully evaluated, and consult your hospital's infection preventionist.

Cleaning, Decontamination and Sterilization

Cleaning means removing foreign material, such as blood, but cleaned items may still harbor microorganisms. Decontamination, on the other hand, removes disease-producing microorganisms and makes the object safe to use (CDC Guidelines for Disinfection and Sterilization in Healthcare Facilities, 2008).

Are disinfected instruments, equipment, or supplies also sterile?
No. Sterilization completely kills or eliminates all forms of microbial life. Disinfection doesn't kill everything. It eliminates many or all pathogenic microorganisms on inanimate objects, but even high-level disinfection kills only some bacterial spores. There are three levels of disinfection:

- **Low-Level Disinfection**: Kills most bacteria, some fungi, and some viruses. Will not kill bacterial spores and is less active against gram-negative rods (*pseudomonas*) and *mycobacteria.*
- **Intermediate-Level Disinfection**: Kills bacteria, *mycobacteria* (TB), most fungi, and most viruses. Does not kill resistant bacterial spores.
- **High-Level Disinfection**: Kills bacteria, *mycobacteria* (TB), fungi, viruses, and some bacterial spores(CDC Guidelines for Disinfection and Sterilization in Healthcare Facilities, 2008).

Cleaning, Decontamination & Sterilization: FAQs

How do outbreaks of infections result from contaminated equipment?
Sometimes hospital personnel mistakenly reuse disposable equipment or the devices are improperly cleaned, disinfected, or sterilized. For example, putting too many instruments into a sterilizer may allow some pathogens to survive, as will operating the sterilizer for too short a time or at too low of a temperature.

Sometimes unwanted pathogens contaminate the cleaning solutions, water supply, hemodialysis equipment, or automated cleaning systems. Sometimes the incorrect disinfecting solution is used, it is diluted improperly, or it becomes cross-contaminated. All aspects of the process must be monitored to ensure quality.

What happens to reusable devices after each use?
First, they are kept in covered containers and stored in dirty utility areas until they can be processed. Many are soaked in a "pre-soak" enzymatic solution. Some devices can't be pre-soaked, or pre-soaked for only a limited time, because they will be corroded by the solution. After pre-soaking, they are cleaned with a detergent.

Devices used on a normally sterile body cavity are sterilized with steam or chemicals. Devices used on parts of the body that aren't sterile (such as the upper respiratory tract and gastrointestinal tract) undergo high-level disinfection following the manufacturer's guidelines to make the equipment safe without damaging it. Devices used on intact skin are cleaned with solutions recommended by their manufacturers to kill vegetative bacteria and viruses. After they're disinfected or sterilized, devices are wrapped and stored in a clean and dry environment.

How do I know if a "sterile" item is still sterile or a disinfected item is still safe?
The sterility of equipment is now event related, as opposed to the former standard of a pre-determined time frame in which sterility could be ensured. This standard is known as Event Related Sterility (ERS). Recommended practices issued by the Association of periOperative Registered Nurses (AORN, 2010) support event-related sterility. According to AORN, the length of time an item is considered sterile depends on:

- Type and configuration of packaging materials used
- The number of times a package is handled before use
- Environmental conditions of the storage area (e.g., cleanliness, temperature, humidity)
- Use of dust covers and method of sealing

Before using sterile equipment, check the processing date and ensure that the wrap hasn't been damaged. Follow your hospital's policy concerning rotating stock. When opening a sterile supply, check the indicator inside the pack to ensure that it has passed through the sterilization process.

Make sure that rooms, beds, examining tables, and counters are adequately disinfected between patients.

Follow your hospital's policies for disinfecting common reusable equipment, such as electronic thermometers and sphygmomanometers.

Occupational Exposure to Infectious & Communicable Diseases

Health care providers are at risk for occupational exposure to bloodborne pathogens, including hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). Exposures occur through needlesticks or cuts from other sharp instruments contaminated with an infected patient's blood or through contact of the eye, nose, mouth, or skin with a patient's blood.

Important factors that influence the overall risk for occupational exposures to bloodborne pathogens include the number of infected individuals in the patient population and the type and number of blood contacts. Most exposures do not result in infection. Following a specific exposure, the risk of infection may vary with:

- The pathogen involved
- The type of exposure
- The amount of blood involved in the exposure
- The amount of virus in the patient's blood at the time of exposure

Your employer should have in place a system for reporting exposures in order to quickly evaluate the risk of infection, inform you about treatments available to help prevent infection, monitor you for side effects of treatments, and determine if infection occurs. This may involve testing your blood and that of the source patient and offering appropriate postexposure treatment.

Healthcare Workers: Immunizations

Because of their contact with patients or infective material from patients, many healthcare workers are at risk for exposure to and possible transmission of vaccine-preventable diseases.

Maintenance of immunity is therefore an essential part of infection prevention programs for healthcare workers. Optimal use of immunizing agents safeguards the health of workers and protects patients from becoming infected through exposure to infected workers (CDC, 2010).

Consistent immunization programs could substantially reduce both the number of susceptible healthcare workers in hospitals and health departments and the attendant risks for transmission of vaccine-preventable diseases to other workers and patients

The American Hospital Association (AHA) has endorsed the concept of immunization programs for both hospital personnel and patients. Nurses are usually screened for antibodies or a history of immunization for rubella, measles, varicella and hepatitis B. Depending on the kinds of patients you care for, you may also be screened for, and choose to be immunized against other infectious diseases, such as hepatitis A.

Healthcare Workers: TB Testing

Is the BCG Vaccine effective against TB?

There is a lot of confusion about TB skin testing in persons who have received the BCG Vaccine (either recently or as a child). The following information reflects current medical standards.

- The BCG Vaccine is NOT 100% effective against TB. The vaccine is designed to prevent the more severe childhood forms of TB and their concurrent problems. It is usually administered to children in high risk areas to decrease the risk of infection with TB, but is not 100% effective.
- The BCG Vaccine loses its effectiveness over time. Generally the vaccine is ineffective after 5 years.

Is BCG Vaccine a contra-indication for the TB Skin Test?

- The BCG Vaccine is NOT a contra-indication to having a TB Skin Test. It is recommended that persons who have had the BCG vaccine have a TB skin test as well.
- The ONLY contraindication to a TB skin test is a previous positive result. Once a positive result is seen, the test will always remain positive. A positive PPD in a person who has been vaccinated with BCG needs to be interpreted carefully.

How often do I need to have a TB skin test?

The CDC recommends that all healthcare workers who have the potential for exposure to *M. Tuberculosis* should be included in a TB surveillance program (CDC, 2005). In high risk occupations, such as respiratory therapy, testing should be more frequent. Your hospital's infection preventionist or your local health department may request that nurses be tested sooner if they were exposed to a patient with unusual or very communicable TB infections (CDC, 2005).

What types of TB tests are available?

There are two kinds of tests that can be used to help detect TB infection – the TB skin test (TST) and special TB blood tests. A positive TB skin test or TB blood test only tells that a person has been infected with TB bacteria. It does not tell whether or not the person has progressed to TB disease. Other tests, such as a chest x-ray and a sample of sputum, are needed to see whether the person has TB disease.

What kind of TB skin test do nurses get?

Healthcare workers receive Mantoux TB skin tests that inject 0.1 mL (5 units) of purified protein derivative (PPD) tuberculin intradermally, raising a wheal 6 to 10 mm in diameter (CDC, 2010).

Can I safety receive a Mantoux TB skin test if I'm pregnant?
Yes. The tests are safe and reliable throughout pregnancy (CDC, 2010).

Can people who recently received live-virus vaccines be tested using Mantoux TB skin tests?
Live-virus vaccines may cause falsely negative TB skin tests. For live-virus measles vaccine, the most common live-virus vaccine, either place the Mantoux TB skin test on the day of vaccination or wait 4 to 6 weeks after vaccination.

Mantoux TB Skin Testing

When must a Mantoux TB skin test be read?
Have the Mantoux test read between 48 and 72 hours after it's injected (CDC, 2010).

What classifies a Mantoux TB skin test as positive?
For most healthcare workers a raised area (induration) of > 10 mm indicates a positive TB skin test, but induration > 5 mm indicates a positive result for people with:

- HIV infection
- Recent contact with people with TB
- Chest x-ray findings consistent with old healed TB
- Organ transplants
- Other forms of immunosuppression

Mantoux TB Skin Testing

Does a negative Mantoux TB skin test always mean that the person is free of TB?
No. Between 10% to 25% of people with TB disease still have negative TB skin tests when they are diagnosed by other methods. The test may have been administered or read incorrectly. Some people are unable to mount adequate immune responses to show delayed-type hypersensitivity to the TB antigen. People with the following conditions are likely to be either temporarily or chronically immunosuppressed and have false-negative TB skin tests:

- HIV infection
- Other viral infections
- Overwhelming TB disease
- Severe or febrile illnesses
- Live-virus vaccinations
- Immunosuppressive therapy

Booster TB Skin Test

What is a booster or two-step TB skin test?
For their first screening, healthcare workers usually receive two-step skin tests using Mantoux TB skin tests. If the first test result is negative, a second Mantoux TB skin test is administered one to three weeks later. This is called boosting.

People who react positively on the second TB skin test are considered to have a past infection and treated appropriately. Those with negative results of the second TB skin test are considered uninfected. If they show a positive skin test on screening tests months or years later, they will be considered newly infected and treated accordingly (CDC, 2000).

TB Blood Tests

How does the special TB blood test work?
The special blood tests (interferon-gamma release assays [IGRAs]) measure how the immune system reacts to the bacteria that cause TB. Blood samples are mixed with antigens (substances that can produce an immune response) and controls. After incubation of the blood with antigens for 16 to 24 hours, the amount of interferon-gamma (IFN-gamma) is measured.

If the patient is infected with *M. tuberculosis*, their white blood cells will release IFN-gamma in response to contact with the TB antigens. The QFT-G results are based on the amount of IFN-gamma that is released in response to the antigens.

Since they are relatively new, few health departments offer these blood tests (CDC, 2010).

Can the special TB blood test be used to confirm a diagnosis of TB?
Clinical evaluation and additional tests (such as a chest radiograph, sputum smear, and culture) are needed in addition to the TB blood test to confirm a diagnosis of latent TB infection or TB disease.

What are the advantages of the special TB test?
- It requires a single patient visit to draw a blood sample.
- Results can be available within 24 hours.
- Does not boost responses measured by subsequent tests, which can happen with tuberculin skin tests (TST).
- Is not subject to reader bias that can occur with TST.
- Is not affected by prior BCG (bacille Calmette-Guérin) vaccination.

What are the disadvantages and limitations of the special TB test?
- Blood samples must be processed within 12 hours after collection while white blood cells are still viable.
- There are limited data on the use of QFT-G in children younger than 17 years of age, among persons recently exposed to M. tuberculosis, and in immunocompromised persons.
- Errors in collecting or transporting blood specimens or in running and interpreting the assay can decrease the accuracy of QFT-G.
- Limited data on the use of QFT-G to determine who is at risk for developing TB disease.

When should you use the test?
QFT-G can be used in all circumstances in which the tuberculin skin test (TST) is currently used, including contact investigations, evaluation of recent immigrants who have had BCG vaccination, and TB screening of healthcare workers and others undergoing serial evaluation for *M. tuberculosis*. However, caution should be used when testing certain populations because of limited data in the use of QFT-G.

Before the QFT-G is conducted, arrangements should be made with a qualified laboratory and courier service, if needed, to ensure prompt and proper processing of blood.

What are the steps in administering the test?
- Confirm arrangements for testing in a qualified laboratory and arrange for delivery of the blood sample in time for the laboratory to initiate testing within 12 hours of blood collection.
- Draw a sample of whole blood from patient into a tube with heparin anti-clotting agent, according to manufacturer's instructions.
- Schedule an appointment for the patient to receive test results and, if needed, medical evaluation and possible treatment for TB disease or LTBI.

How do you interpret test results?
Interpretation of QFT-G results is based on IFN-gamma concentrations in test samples. Each QFT-G result and its interpretation should be considered in conjunction with other epidemiological, historical, physical, and diagnostic findings.

A positive result suggests that *M. tuberculosis* infection is likely; a negative result suggests that infection is unlikely; and indeterminate result suggests QFT-G results cannot be interpreted as a result of low mitogen response or high background response.

The QuantiFERON®-TB Gold test (QFT-G) and T-SPOT®.TB test are two examples of special TB blood tests.

BCG Vaccine

What is the BCG Vaccine?
BCG, or bacille Calmette-Guerin, is a vaccine for tuberculosis (TB) disease.
Many foreign-born persons have been BCG-vaccinated. BCG is used in many countries with a high prevalence of TB to prevent childhood tuberculous meningitis and miliary disease.

Is the BCG vaccine used in the United States?
The BCG Vaccine is not generally recommended for use in the United States for several reasons. First, the risk of infection with Mycobacterium tuberculosis is very low in the US today. Second, the effectiveness of the vaccine against adult pulmonary TB is variable, and lastly, the vaccine has the potential to interfere with tuberculin skin test reactivity.

When should healthcare workers in the US receive the BCG vaccination?
HCPs in the US should be considered for the BCG Vaccine on an individual basis when:

- There is ongoing transmission of drug-resistant M. tuberculosis strains to healthcare workers and subsequent infection is likely; or
- Comprehensive TB infection prevention precautions have been implemented, but have not been successful.

Healthcare workers considered for BCG vaccination should be counseled regarding the risks and benefits associated with both BCG vaccination and treatment of latent TB infection (LTBI).

The BCG vaccine should be considered only for very select persons who meet specific criteria and in consultation with a TB expert.

Other Communicable Diseases: FAQs

What happens if I'm exposed to a communicable disease, such as TB, varicella, rubella, rubeola, pertussis, mumps, or meningococcal meningitis?
You will need to be evaluated. If you are susceptible, you may receive treatment, such as prophylactic antibiotics after exposure to meningococcal meningitis. You may not be able to work until you are shown to be noninfectious.

If you are diagnosed with an infectious disease, consult with your hospital's infection prevention department or occupational health clinic to determine whether you can work.

Are there general symptoms that I should have evaluated?
Yes. You should be evaluated if you have a fever, cough, rash, vesicular lesions, draining wounds, weeping dermatitis, vomiting, or diarrhea.

Which bloodborne pathogens are nurses commonly exposed to?
Evaluation usually focuses on HIV, HBV, and HCV. But depending on the patient's diagnoses, you may be tested for other infectious diseases as well.

HIV Exposure

What should I do if I think I've been exposed to HIV?
Seek treatment as soon as possible. To be effective, post-exposure prophylaxis (PEP) must start within hours of exposure. The decision to start antiviral treatment and which medications to use, depends on the kind of injury, the severity of the exposure and the patient source.

If PEP is started and tolerated, it usually lasts for approximately four weeks. Follow-up HIV antibody testing should be repeated periodically during the first six months, if previous tests results were negative.

During the first six months, exposed nurses should (CDC, 2001):

- Abstain from sexual activity or use condoms.
- Avoid pregnancy.

- Discontinue breastfeeding.
- Avoid donating blood, plasma, semen, tissue, or organs.

For the latest guidelines for testing and treatment following an occupational exposure, see the "Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis." (http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5011a1.htm).

Test Yourself

Post-exposure prophylaxis usually lasts for approximately __ weeks.

a) Two
b) Four
c) Six
d) Eight

HIV Exposure: FAQs

Can HIV-infected nurses continue to practice?

Yes. The patient-care responsibilities of an exposed person do not need to be modified based solely on an HIV exposure, to prevent transmission to patients. If HIV seroconversion is detected, the person should be evaluated according to published recommendations for infected healthcare professionals (CDC, 2010).

Nurses infected with HIV should continue to follow standard precautions, wash their hands, use gloves, and handle sharps carefully. Nurses with advanced HIV disease, certain opportunistic infections, or HIV-related dementia may require additional evaluation and may be furloughed or practice with restrictions (CDC, 2001).

Can I be forced to be tested for HIV?

No. Healthcare workers must provide written informed consents before they can be tested for HIV. If they agree, their test results will remain confidential. If they refuse, they can't be disciplined, terminated, demoted, or promoted based on their decision; however, their practice may be evaluated and changed based on the degree of potential risks to patients.

Can patients be forced to be tested for HIV following a healthcare worker's exposure to their blood or body fluids?

HIV screening is recommended for patients in all healthcare settings after the patient is notified that testing will be performed, unless the patient declines (opt-out screening).

Separate written consent for HIV testing should not be required; general consent for medical care should be considered sufficient to encompass consent for HIV testing.

However, certain states require written informed consent for all HIV testing; others specifically exempt healthcare providers from this requirement, and several explicitly state that no separate consent for an HIV test is necessary when a general consent for care is in effect.

Certain states, jurisdictions, or agencies may have statutory or other regulatory requirements for pretest counseling, written consent, confirmatory testing, or communicating HIV test results. CDC recommendations for HIV testing in healthcare settings also differ from guidelines for nonclinical settings, and state requirements may differ as well. Providers should become familiar with the regulations that apply in their practice setting (CDC, 2010).

Did You Know

Opt-out screening means performing an HIV test after notifying the patient 1) that the test will be performed and 2) that the patient may elect to decline or defer testing.

Opt-in screening means testing is offered and the patient is required to actively give permission for testing (CDC, 2010).

Hepatitis B Exposure

What treatments / testing can I expect if I've been exposed to hepatitis B?

If you haven't already been immunized against the Hepatitis B Virus (HBV), expect to receive Hepatitis B Immune Globulin (HBIG) to boost your immune system to help prevent infection with HBV. For the best protection, HBIG should be administered within 24 hours of the exposure. To provide long-term immunity, nurses may also receive a simultaneous dose of hepatitis B vaccine administered in another injection site.

Nurses, who were previously vaccinated against HBV, but show inadequate antibodies, also receive a single injection of HBIG and a HBV vaccine booster.

Nurses exposed to HBV can expect the following (CDC, 2001):

- Baseline measurement of HBV to determine previous HBV infection or antibody titers, if previously vaccinated.
- Follow-up testing of HBV three to six months after the exposure for a previously uninfected nurse to determine infection that resulted from the reported exposure.
- If infected, ongoing monitoring by primary healthcare provider.
- No need to change sexual activities, defer pregnancy, or stop breastfeeding.

Can nurses infected with HBV continue to practice?

Usually nurses infected with HBV don't need to modify their patient care responsibilities; however, nurses who develop symptoms of acute hepatitis B need further evaluation of their ability to practice. Nurses infected with HBV should continue to follow standard precautions, wash their hands, use gloves, and handle sharps carefully. Check your facility's policy regarding this issue.

Test Yourself

For the best protection, HGIB should be administered within 24 hours of an exposure to HBV.

a) True

b) False

Hepatitis C Exposure

What treatment / testing can I expect if I've been exposed to hepatitis C?

Neither immune globulin nor antiviral medications prevent infection with HCV following a needle-stick injury or other significant occupational exposure. Healthcare workers who become infected and develop chronic hepatitis C will probably receive treatment later. If you're exposed to HCV, you can expect the following, although your employer may require additional measures (CDC, 2001):

- Baseline measurement of HCV and ALT (alanine aminotransferase) to determine previous HCV infection and liver damage.
- Follow-up testing of HCV and ALT four to six months after the exposure for a previously uninfected nurse to determine infection that resulted from the reported exposure.
- If infected, ongoing monitoring by primary healthcare provider.
- No need to change sexual activities, defer pregnancy, or stop breastfeeding.
- Instructed not to donate blood, semen, or organs until shown to be free of HCV infection.

Can nurses infected with HCV, continue to practice?

Generally, nurses infected with HCV don't need to modify their patient care responsibilities, but they should continue to follow standard precautions, wash their hands, use gloves, and handle sharps carefully (CDC, 2008).

Test Yourself

Immune globulin and antiviral medications prevent infection with HCV following a needle-stick injury or other significant occupational exposure.

a) True

b) False

Developing an Infection: FAQs

What happens if I think I have an infectious disease?
Each of the hundreds of infectious diseases requires distinct treatments and measures to protect others. Consult your primary-care provider and your hospital's occupational health clinic or infectious disease department to determine whether you can continue to practice or must practice with restrictions.

In some instances, federal, state, and local public health guidelines determine treatment and work furloughs. The decision is based in part on the scope of your practice, the invasiveness of the procedures you perform, the kinds of patients you care for, your overall physical health, and whether your infection impairs your cognitive functioning. Some infectious diseases must be reported to your state department of health.

Are patients notified if they've been exposed to an infectious disease from a healthcare worker?
Yes. Patients are entitled to know about exposures and to receive appropriate testing and treatments; however, the healthcare worker's name and details of their health status remains confidential. Patients must provide written consent before some tests are performed.

What about weeping dermatitis or skin lesions?
Consult your primary-care provider and your hospital's occupational health clinic or infectious disease department to determine whether working puts you or your patients at risk.

What if I disagree with my employer about my ability to practice safely after exposure to an infectious disease?
Hospitals are expected to consult an expert panel to evaluate employees exposed to or infected with infectious diseases. They should follow federal guidelines and impose the least restrictive alternatives. You or your employer can also consult your local or state Department of Health.

Conclusion

Regulations regarding infectious diseases, infection prevention, and related issues are designed to protect both the patient and the healthcare professional.

Basic knowledge of guidelines and how they impact your practice will assist in prevention of infection and reduce the chances of transmission of disease.

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