Infection Control:

New York State Mandatory Training

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New York State

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Answer Sheet: Infection Control: *New York State Mandatory Training*

1. _____	5. _____	9. _____	13. _____	17. _____
2. _____	6. _____	10. _____	14. _____	18. _____
3. _____	7. _____	11. _____	15. _____	19. _____
4. _____	8. _____	12. _____	16. _____	20. _____

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Objectives

Element I

- Identify benefits to patients and healthcare providers of adhering to scientifically accepted principles and practices of infection control;
- State the legal requirement for select licensed professionals regarding adhering to scientifically accepted principles and practices of infection control.

Element II

- Describe how pathogenic organisms may be spread in healthcare settings;
- Identify the factors which influence the outcome of an exposure;
- List strategies for preventing transmission of pathogenic organisms;
- Describe how infection control concepts are applied in professional practice.

Element III

- Define healthcare-associated disease transmission, engineering controls, safe injection practices, and work practice controls;
- Describe specific high-risk practices and procedures that increase the opportunity for healthcare worker and patient exposure to potentially infectious material;
- Describe specific measures to prevent transmission of bloodborne pathogens from patient to patient, healthcare worker to patient, and patient to healthcare worker via contaminated injection equipment;
- Identify work practice controls designed to eliminate the transmission of bloodborne pathogens during use of sharp instruments (e.g., scalpel blades and their holders (if not disposable), lancets, lancet platforms/pens, puncture devices, injections); and
- Identify where engineering or work practice controls can be utilized to prevent patient exposure to bloodborne pathogens.

Element IV

- Describe the circumstances which require the use of barriers and personal protective equipment to prevent patient or healthcare worker contact with potentially infectious material;
- Identify specific barriers or personal protective equipment for patient and healthcare worker protection from exposure to potentially infectious material.

Element V

- Define cleaning, disinfection, and sterilization;
- Differentiate between non critical, semi critical, and critical medical devices;
- Describe the three levels of disinfection;
- Discuss the importance of the correct application of reprocessing methods for assuring the safety and integrity of patient care equipment in preventing transmission of bloodborne pathogens;

Element VI

- Discuss the professional's responsibility for maintaining a safe patient care environment in all healthcare settings; and
- Identify strategies for, and importance of, effective and appropriate pre-cleaning, chemical disinfection, and sterilization of instruments and medical devices aimed at preventing transmission of bloodborne pathogens.

Introduction

Today's healthcare environment provides quality treatment and care to patients in a variety of settings. Despite the advances in technology and science, the healthcare environment also contains threats from infectious agents. There are an estimated two million healthcare associated infections (HAIs) that occur each year (CDC, 2007). HAIs occur during healthcare delivery in any setting (e.g., hospitals, long-term care facilities, ambulatory settings, home care). This number has remained generally stable over the past 30 years despite multiple changes to the healthcare system: Fewer hospitals, increased use of technology, shorter lengths of stay, a shift in care delivery from in-patient to out-patient, the shortage of nurses at the bedside, drug resistant organisms,

newly emerging infectious agents, etc. It is clear that despite these many changes, healthcare providers must be continually vigilant to the potential for the spread of infection.

Of the almost 2 million HAIs annually (1.7 million infections), 99,000 people die from these infections (CDC, 2007). The State of New York takes the spread of infection seriously. Chapter 768 of the Laws of 1992 contains legislation that requires select healthcare professionals take two hours of New York State Education Department approved coursework on infection control. In 1999, the coursework was revised to include an additional legal requirement regarding infection control and unprofessional conduct for multiple professionals. In 2008, new laws included physicians, physician assistants and specialist assistants in the requirement to practice in accordance to scientific and professional standards of infection control and possible charges of unprofessional conduct if violations occur. Also in 2008 the Infection Control Training curriculum was revised reflecting current Centers for Disease Control and Prevention (CDC) recommendations. This course reflects those changes.

Identified professionals must receive infection control training every four years. The initial coursework in this mandatory training must include the six elements listed below; however in future four year periods, professionals may either repeat this coursework or take infection control training that is specifically relevant to their clinical work. Current requirements are listed at http://www.op.nysed.gov/icmemo.htm.

Element I: The healthcare professional's responsibility to adhere to scientifically accepted principles and practices of infection control and to monitor the performance of those for whom the professional is responsible.

Element II: The modes and mechanisms of transmission of pathogenic organisms in the healthcare setting and strategies for prevention and control.

Element III: The use of engineering and work practice controls to reduce the opportunity for patient and healthcare worker exposure to potentially infectious material in all healthcare settings.

Element IV: Selection and use of barriers and/or personal protective equipment for preventing patient and healthcare worker contact with potentially infectious material.

Element V: The creation and maintenance of a safe environment for patient care through application of infection control principles and practices for cleaning, disinfection, and sterilization.

Element VI: The prevention and management of infectious or communicable disease in healthcare workers.

This course has been approved by the New York State Education Department and meets the mandatory requirement. Upon successful completion of this course, results will be electronically sent to the New York State Education Department. You may want to print out a copy for your own records, but there is no need to submit the certificate to the New York State Education Department, since **Access Continuing Education, Inc.** will submit that information for you.

This thin-section transmission electron micrograph (TEM) depicted the ultrastructural details of a number of *"human immunodeficiency virus"* (HIV) virus particles, or virions. Photo courtesy of CDC; photo credit: Cynthia Goldsmith.

Element I: The first element of the mandatory coursework addresses the professional's responsibility to adhere to scientifically accepted principles and practices of infection control and to monitor the performance of those for whom the professional is responsible.

The National Healthcare Safety Network (NHSN) is a secure, internet-based surveillance system that integrates patient and healthcare personnel safety surveillance systems managed by the Division of Healthcare Quality Promotion (DHQP) at CDC. The NHSN was established in 2005 and integrates three former networks: The National Nosocomial Surveillance System (NNIS), the Dialysis Surveillance Network (DSN), and the National Surveillance System for Healthcare Workers (NaSH). Although most NHSN facilities voluntarily report data, some states, including New York State, have mandatory reporting. Facilities report their healthcare associated infection (HAI) surveillance data for aggregation into a single national database for the following purposes (CDC, 2008):

- Estimation of the magnitude of HAI;
- Discovery of HAI trends;
- Facilitation of inter-and intrahospital comparisons with risk-adjusted data that can be used for local quality improvement activities; and
- Assistance for facilities in developing surveillance and analysis methods that permit timely recognition of patient safety problems and prompt intervention with appropriate measures.

Currently the majority of facilities in the NHSN system are hospitals, however, the enrollment in this system is growing to include other healthcare facilities such as long term care, ambulatory surgery centers, and others (Edwards, et al., 2008).

As indicated previously, almost 2 million HAIs occur annually and 99,000 people die from these infections (CDC, 2007). Of those infections, 99,000 people die from these infections (CDC, 2007). The frequency of healthcare associated infections varies by body site. Of the 1.7 million infections reported among patients, the most common healthcare-associated infections are (CDC, 2007a):

- urinary tract infections (32 percent),
- surgical site infections (22 percent),
- pneumonias (15 percent), and
- bloodstream infections (14 percent).

According to the CDC (2006), the following are infectious diseases that can potentially be acquired in healthcare settings:

• *Acinetobacter* • Bloodborne Pathogens • *Burkholderia cepacia* • Chickenpox (Varicella) • *Clostridium Difficile* • *Clostridium Sordellii* • Creutzfeldt-Jakob Disease (CJD) • Ebola (Viral Hemorrhagic Fever) • Gastrointestinal (GI) Infections • Hepatitis A • Hepatitis B • Hepatitis C • HIV/AIDS • Influenza • MRSA - Methicillin-resistant *Staphylococcus Aureus*	• Mumps • Norovirus • Parvovirus • Poliovirus • Pneumonia • Rubella • SARS • *S. pneumoniae* (Drug resistant) • Tuberculosis • Varicella (Chickenpox) • Viral Hemorrhagic Fever (Ebola) • VISA - Vancomycin Intermediate *Staphylococcus aureus* • VRE - Vancomycin-resistant *enterococci*

In 2009, the CDC published the *Direct Medical Costs of Healthcare-Associated Infections in US Hospitals and the Benefits of Prevention.* This report used results from published medical and economic literature to provide a range of estimates for the annual direct hospital cost of treating healthcare-associated infections (HAIs) in the United States. Applying two different Consumer Price Index (CPI) adjustments to account for the rate of inflation in hospital resource prices, the overall annual direct medical costs of HAI to U.S. hospitals ranges from $28.4 to $33.8 billion (after adjusting to 2007 dollars).

Clearly the prevalence of HAIs contributes significantly to increased morbidity, mortality and cost in healthcare. Therefore, it is critical that healthcare professionals do all they can to minimize the risk that their behavior contributes to the spread of infection.

Healthcare professionals, although well aware of the importance of accepted principles and practices of infection control, may at times, for multiple reasons, fail to follow these accepted principles and practices. However, professionals have both an **ethical and professional responsibility** to adhere to scientifically accepted or evidence based practices and principles of infection control.

There are multiple organizations that have developed "best practices" related to infection control. For example, the CDC has developed multiple guidelines for preventing infections in patients and healthcare personnel, as well as treatment guidelines, should exposure occur. These guidelines can be accessed from the CDC website at www.cdc.gov/ncidod/dhqp/guidelines.html.

- Other organizations that focus on scientifically accepted practices and principles of infection control include:
- Society for Healthcare Epidemiology of America (SHEA) www.shea-online.org
- Association of Professionals in Infection Control and Epidemiology (APIC) www.apic.org
- Joint Commission http://www.jointcommission.org/
- Infectious Disease Society of America (IDSA) www.idsociety.org

Multiple professional disciplines' **Codes of Ethics** require that the professional maintain current knowledge in the field.

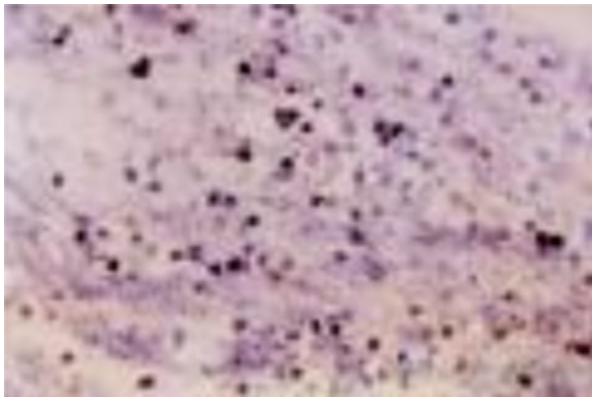
In 1999 New York State included the **legal responsibility** to adhere to such principles. A law was passed in which the professional may be charged with unprofessional conduct if he or she fails to adhere to scientifically accepted principles and practices of infection control. This is true for the professional her or himself, but also true for those whom the professional has clinical or administrative oversight. In 2008, physicians, physician

assistants and specialist assistants were added to the professions who had a legal responsibility to adhere to scientifically accepted principles and practices of infection control and they now can be disciplined if they fail to do so.

Some examples of these legal requirements may include:

- An attending physician does not correct the resident physician in the emergency room who has neglected to utilize the "sharps" containers after giving injections to patients;
- A licensed practical nurse does not intervene to correct a certified nursing assistant who does not wash his/her hands after providing care to a resident in a long term care facility;
- Certified nursing assistant, for whom the registered nurse has supervisory responsibility, does not wash her hands after removing gloves after completing care to a resident in a long term care facility. The nurse can be charged with unprofessional conduct if she does not intervene to correct the situation;
- An registered nurse witnesses a colleague utilizing unsafe injection practices and does nothing;
- A laboratory supervisor who looks the other way with one lab technician, an excellent employee, who just can't seem to remember to wear gloves during phlebotomy;
- A dentist who witnesses the assistant not changing gloves between patients and does not intervene.
- A registered nurse, in the operating room, notes that the temperature and the humidity in the storage room is unusually high and wonders if the sterilized instruments used by the OR staff may be contaminated, but takes no action.

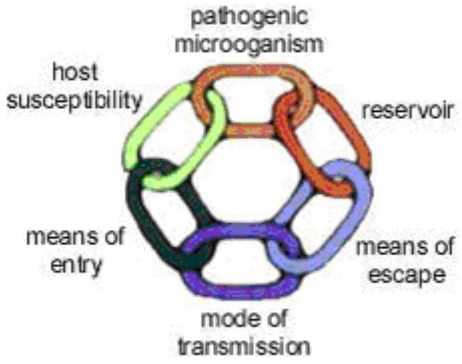
All of the examples above illustrate that professionals must take the responsibility to adhere to scientific principles of infection control. They must themselves practice in such a manner, but in addition, New York State Law requires that these professionals must also insure that those for whom they have administrative or clinical oversight also practice to this standard. Professionals who fail to follow accepted standards of infection control will have the complaint investigated. Possible outcomes of such charges include: disciplinary action, revocation of professional license and professional liability.



Bacillus anthracis

Element II: The modes and mechanisms of transmission of pathogenic organisms in the healthcare setting and strategies for prevention and control.

The "Chain of Infection" is a basic component of understanding the prevention and control of infection that most healthcare workers recall from their early days of training. It is a critical concept in infection control that is worth reviewing:



The **pathogen** is the microorganism that causes infection. They include bacteria, viruses, fungi and parasites. There must be an adequate number of pathogens to cause disease. Infectious agents transmitted during healthcare derive primarily from human sources but inanimate environmental sources have also been implicated in transmission (Siegel, et al., 2007).

The **reservoir** is the place where microorganisms live, such as in humans and animals, in soils, food, plants, air or water. The reservoir must meet the needs of the pathogen in order for the pathogen to survive and multiply. Human reservoirs include patients, healthcare personnel, and household members and other visitors. Such source individuals may have active infections, may be in the asymptomatic and/or incubation period of an infectious disease, or may be transiently or chronically colonized with pathogenic microorganisms, particularly in the respiratory and gastrointestinal tracts. The endogenous flora of patients (e.g., bacteria residing in the respiratory or gastrointestinal tract) also are the source of HAIs (Siegel, et al., 2007).

The **means of escape** are how the microorganism leaves the reservoir. These portals can be:

- Respiratory- for example, viruses that cause the common cold, Mycobacterium tuberculosis, and Haemophilus influenza utilizes this means of exit from the reservoir.
- Genitourinary- for example, sexually transmitted diseases such as syphillus or HIV.
- Alimentary - for example, salmonella, rotavirus, C. difficile, Giardia.
- Skin - for example, scabies, impetigo.
- Blood and body fluids – HIV, Hepatitis B and C.
- Transplancental - for example, Rubella and HIV.

Some microorganisms have more than one means of escape - for example, chickenpox can be spread via respiratory source or the patient's skin. Bloodborne pathogens such as HIV, Hepatitis B and C can be spread through blood and from fluid from the genitourinary system.

The **mode of transmission** is how the pathogen moves from place to place. This can occur through three principle routes:

- **Contact transmission**, which is further divided into (Siegel, et al., 2007):
    - **Direct transmission** occurs when microorganisms are transferred from one infected person to another person without a contaminated intermediate object or person. Opportunities for direct contact transmission between patients and healthcare personnel include:

- blood or other blood-containing body fluids from a patient directlyenters a caregiver's body through contact with a mucous membrane or breaks (i.e., cuts, abrasions) in the skin .
- mites from a scabies-infested patient are transferred to the skin of a caregiver while he/she is having direct ungloved contact with the patient's skin.
- a healthcare provider develops herpetic whitlow on a finger after contact with HSV when providing oral care to a patient without using gloves or HSV is transmitted to a patient from a herpetic whitlow on an ungloved hand of a healthcare worker.

o **Indirect transmission** involves the transfer of an infectious agent through a contaminated intermediate object or person. In the absence of a point-source outbreak, it is difficult to determine how indirect transmission occurs. However, extensive evidence suggests that the contaminated hands of healthcare personnel are important contributors to indirect contact transmission. Examples of opportunities for indirect contact transmission include (Siegel, et al., 2007):

- Hands of healthcare personnel may transmit pathogens after touching an infected or colonized body site on one patient or a contaminated inanimate object, if hand hygiene is not performed before touching another patient.
- Patient-care devices (e.g., electronic thermometers, glucose monitoring devices) may transmit pathogens if devices contaminated with blood or body fluids are shared between patients without cleaning and disinfecting between patients.
- Shared toys may become a vehicle for transmitting respiratory viruses or pathogenic bacteria among pediatric patients.
- Instruments that are inadequately cleaned between patients before disinfection or sterilization (e.g., endoscopes or surgical instruments) or that have manufacturing defects that interfere with the effectiveness of reprocessing may transmit bacterial and viral pathogens.
- Clothing, uniforms, laboratory coats, or isolation gowns used as personal protective equipment (PPE), may become contaminated with potential pathogens after care of a patient colonized or infected with an infectious agent. Although contaminated clothing has not been implicated directly in transmission, the potential exists for soiled garments to transfer infectious agents to successive patients.

- **Droplet transmission** is, technically, a form of contact transmission, and some infectious agents transmitted by the droplet route also may be transmitted by the direct and indirect contact routes. However, in contrast to contact transmission, respiratory droplets carrying infectious pathogens transmit infection when they travel directly from the respiratory tract of the infectious individual to susceptible mucosal surfaces of the recipient, generally over short distances, necessitating facial protection. Respiratory droplets are generated when an infected person coughs, sneezes, or talks or during procedures such as suctioning, endotracheal intubation, cough induction by chest physiotherapy and cardiopulmonary resuscitation (Siegel, et al., 2007).

  Studies have shown that the nasal mucosa, conjunctivae and less frequently the mouth, are susceptible portals of entry for respiratory viruses. The maximum distance for droplet transmission is currently unresolved; historically, the area of defined risk has been a distance of less than 3 feet around the patient. Using this distance for donning masks has been effective in preventing transmission of infectious agents via the droplet route. There is some evidence to suggest that some droplets (SARS and smallpox) could reach persons located 6 feet or more from their source. It is likely that the distance droplets travel depends on the velocity and mechanism by which respiratory droplets are propelled from the source, the density of respiratory secretions, environmental factors such as temperature and humidity, and the ability of the pathogen to maintain infectivity over that distance. Based on these considerations, it may be prudent to don a mask when within 6 to 10 feet of the patient or upon entry into the patient's room, especially when exposure to emerging or highly virulent pathogens is likely. More studies are needed to improve understanding of droplet transmission under various circumstances (Siegel, et al., 2007).

Droplet size is another variable under discussion. Droplets traditionally have been defined as being >5 µm in size. Droplet nuclei, particles arising from desiccation of suspended droplets, have been associated with airborne transmission and defined as <5 µm in size. Observations of particle dynamics have demonstrated that a range of droplet sizes, including those with diameters of 30 microns or greater, can remain suspended in the air. The behavior of droplets and droplet nuclei affect recommendations for preventing transmission. Whereas fine airborne particles containing infectious pathogens can remain a lot in the air, requiring an airborne infection isolation room (AIIR) to prevent its dissemination within a facility; organisms transmitted by the droplet route cannot remain aloft in the air and therefore do not require special air handling and ventilation. Examples of infectious agents that are transmitted via the droplet route include *Bordetella pertussis*, influenza virus 23, adenovirus 111 , rhinovirus, *Mycoplasma pneumoniae*, SARS-associated coronavirus (SARS-CoV), group A streptococcus, and *Neisseria meningitides* (Siegel, et al., 2007).

- **Airborne transmission** occurs by dissemination of either airborne droplet nuclei or small particles in the respirable size range containing infectious agents that remain a lot in the air over time and distance (e.g., spores of *Aspergillus spp*, and *Mycobacterium tuberculosis*) (Siegel, et al., 2007).

  Microorganisms carried in this manner may be dispersed over long distances by air currents and may be inhaled by susceptible individuals who have not had face-to-face contact with (or been in the same room with) the infectious individual. Preventing the spread of pathogens that are transmitted by the airborne route requires the use of special air handling and ventilation systems (e.g., AIIRs) to contain and then safely remove the infectious agent. Infectious agents to which this applies include *Mycobacterium tuberculosis*, rubeola virus (measles), and varicella-zoster virus (chickenpox). In addition, published data suggest the possibility that variola virus (smallpox) may be transmitted over long distances through the air under unusual circumstances and AIIRs are recommended for this agent as well; however, droplet and contact routes are the more frequent routes of transmission for smallpox. In addition to AIIRs, respiratory protection with NIOSH certified N95 or higher level respirator is recommended for healthcare personnel entering the AIIR to prevent acquisition of airborne infectious agents (Siegel, et al., 2007).

The **means of entry** is how the microorganism enters the host. Often this is the same means from which the organism left the reservoir.

The **susceptible host** is the person who may become infected. Infection is the result of a complex interrelationship between a potential host and an infectious agent. Most of the factors that influence infection and the occurrence and severity of disease are related to the host. However, characteristics of the host-agent interaction as it relates to pathogenicity, virulence and antigenicity are also important, as are the infectious dose, mechanisms of disease production and route of exposure. There is a spectrum of possible outcomes following exposure to an infectious agent. Some persons exposed to pathogenic microorganisms never develop symptomatic disease while others become severely ill and even die (Siegel, et al., 2007).

Some individuals are prone to becoming transiently or permanently colonized but remain asymptomatic. Still others progress from colonization to symptomatic disease either immediately following exposure, or after a period of asymptomatic colonization. The immune state at the time of exposure to an infectious agent, interaction between pathogens, and virulence factors intrinsic to the agent are important predictors of an individuals' outcome (Siegel, et al., 2007).

Host factors such as extremes of age and underlying disease (e.g. diabetes), human immunodeficiency virus/acquired immune deficiency syndrome [HIV/AIDS], malignancy, and transplants can increase susceptibility to infection as do a variety of medications that alter the normal flora (e.g., antimicrobial agents, gastric acid suppressants, corticosteroids, antirejection drugs, antineoplastic agents, and immunosuppressive drugs). Surgical procedures and radiation therapy impair defenses of the skin and other involved organ systems. Indwelling devices such as urinary catheters, endotracheal tubes, central venous and arterial catheters and synthetic implants facilitate development of HAIs by allowing potential pathogens to bypass local defenses that would ordinarily impede their invasion and by providing surfaces for development of biofilms that may facilitate adherence of microorganisms and protect from antimicrobial activity. Some infections associated with invasive

procedures result from transmission within the healthcare facility, others arise from the patient's endogenous flora.

The host may also have acquired immunity to the pathogen such as may occur through previous infection with the pathogen or through immunization (Siegel, et al., 2007).

The occurrence and presence of all these factors and events is considered the "chain of infection". In the healthcare setting, all of these factors come into play in the spread and the control of infection. Effective infection control strategies prevent disease transmission by interrupting one or more links in the chain of infection (CDC, 2003).

As previously stated, HAIs are a serious problem in healthcare. Every year an estimated 2 million patients acquire HAIs; 99,000 die from their infection. Many infections are transmitted on the hands of healthcare providers and personnel. One of the most important methods for breaking the chain of infection is hand hygiene and hand washing. Despite the sophistication healthcare and the science behind that care, the simple and low-tech intervention of hand hygiene is a significant factor in reducing the spread of infection.

According to the CDC (2002), healthcare personnel only practice hand hygiene about half the time. In the CDC *Guidelines for Isolation Precautions: Preventing Transmission of Infectious Agents in the Healthcare Setting (2007)*, multiple research regarding healthcare professionals and hand hygiene were summarized:

> Differences in observed adherence to proper handwashing and hand hygiene were reported among occupational groups in the same healthcare facility and between experienced and nonexperienced professionals. The self-reports of healthcare providers indicated higher adherence than those reported in observational studies. Among nurses and physicians, the number of years of experience was a negative predictor of adherence. Education was used as the primary intervention to improve adherence in most studies. While positive changes in knowledge and attitude were demonstrated, accompanying behavioral changes were limited or did not occur. Use of engineering controls and facility design concepts for improving adherence is gaining interest.

The hand hygiene guidelines presented here were developed by the CDC's Healthcare Infection Control Practices Advisory Committee (HICPAC), in collaboration with the Society for Healthcare Epidemiology of America (SHEA), the Association of Professionals in Infection Control and Epidemiology (APIC), the Infectious Disease Society of America (IDSA) (2003).

Handwashing should occur (CDC, 2002):

- Whenever hands are visibly dirty or contaminated.
- Before:
    - having contact with patients
    - putting on gloves before inserting any invasive device
    - inserting any invasive device
    - manipulating an invasive device
- After:
    - having contact with a patient's skin
    - having contact with bodily fluids or excretions, non-intact skin, wound dressings, contaminated items
    - having contact with inanimate objects near a patient
    - removing gloves

It is important to remember that even if the healthcare provider did not touch the patient, bacteria can survive for days on patient care equipment and other surfaces in the patient care environment, including bed rails, IV pumps, computer keyboards, etc. Practicing hand hygiene after leaving the patient's room, even when the patient was not touched, is imperative to prevent the transmission of pathogens (CDC, 2003).

Persistence of Bacteria and Viruses on Dry/Inanimate Surfaces (Kramer, Schwebke & Kampf, 2006)

Acinetobacter species → 3 days – 5 months

C. *difficile* (spores) → 5 months

E. *coli* → 1.5 hours – 16 months

Enterococci → 5 days – 4 months

Klebsiella species → 2 hours to >30 months

Pseudomonas → 6 hours – 16 months

Staphylococcus *aureus* → 7 days – 7 months

Influenza → 1-2 days

Rotavirus → 6 -60 days

Alcohol-based hand rubs, either foam or gel, kill more effectively and more quickly than handwashing with soap and water. They are also less damaging to the skin, resulting in less dryness and irritation, leading to fewer breaks in the skin. Hand rubs require less time than handwashing with soap and water and bottles/dispensers can be conveniently placed at the point of care, to be more accessible (CDC, 2003).

ALCOHOL-BASED HAND RUBS ARE MORE EFFECTIVE IN KILLING BACTERIA THAN SOAP AND WATER

An alcohol-based hand rub is the preferred method for hand hygiene in all situations, except for when your hands are visibly dirty or contaminated.

HAND RUB (foam and gel)

- Apply to palm of one hand (the amount used depends on specific hand rub product).
- Rub hands together, covering all surfaces, focusing in particular on the fingertips and fingernails, until dry. Use enough rub to require at least 15 seconds to dry.

HANDWASHING

- Wet hands with water.
- Apply soap.
- Rub hands together for at least 15 seconds, covering all surfaces, focusing on fingertips and fingernails.
- Rinse under running water and dry with disposable towel.
- Use the towel to turn off the faucet.

Colleagues, trainees, and other staff watch one another (CDC, 2003):

Research has shown that the actions of clinicians influence the behavior of others.

Show your colleagues that hand hygiene is an important part of quality care.

Patients also watch what healthcare providers do:

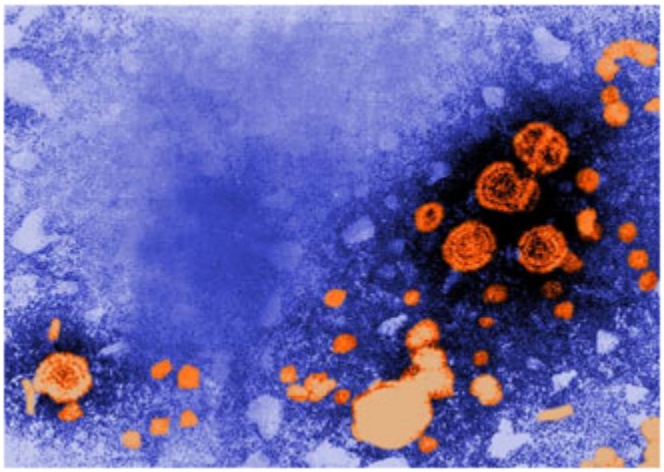
As a healthcare provider, your actions send a powerful message.

Hand lotions are important to prevent skin dryness and irritation. You should use only hospital-approved hand lotions. Other lotions may (CDC, 2002):

- Make hand hygiene less effective.
- Cause breakdown of latex gloves.
- Become contaminated with bacteria if dispensers are refilled.

Artificial Nails (CDC, 2002):

- Healthcare workers who have direct contact with high-risk patients (e.g., ICU, OR) should not wear artificial nails, tips, wraps, etc.
- Natural fingernails should be kept to a length of approximately ¼ inch past the tip of the finger
- Nail polish is acceptable, but should not be chipped.



This transmission electron micrograph (TEM) revealed the presence of hepatitis B virions. The large round virions are known as Dane particles. Photo courtesy of CDC/ Dr. Erskine Palmer.

Element III: Use of Engineering and work practice controls to reduce the opportunity for patient and healthcare worker exposure to potentially infectious material in all healthcare settings.

High Risk Exposures

The healthcare setting can be a risky place to work. During the provision of routine healthcare, there exist high risk practices and procedures that are capable of causing healthcare acquired infection with blood borne pathogens.

More than 8 million U.S. healthcare workers in hospitals may be exposed to blood or other body fluids through the following types of contact (NIOSH, 2004):

- Percutaneous injuries (injuries through the skin) with contaminated sharp instruments such as needles and scalpels (82%)
- Contact with mucous membranes of the eyes, nose, or mouth (14%)
- Exposure of broken or abraded skin (3%)
- Human bites (1%)

The revised New York State syllabus for the Mandatory Infection Control training identifies high risk practices and procedures capable of causing healthcare acquired infection with bloodborne pathogens:

- Percutaneous exposures
- Other sharps injuries
- Mucous membranes and non-intact skin exposures
- Parenteral exposure.

Percutaneous exposures occur through handling/disassembly/disposal/reprocessing of contaminated needles and other sharp objects. This can occur through manipulating contaminated needles and other sharp objects by hand (e.g., removing scalpel blades from holders, removing needles from syringes, or recapping contaminated needles and other sharp objects using a two-handed technique), or by delaying or improperly disposing (e.g., leaving contaminated needles or sharp objects on counters/workspaces or disposing in non-puncture-resistant receptacles) (NYSDOH, 2008; NIOSH, 2004).

Up to 800,000 percutaneous injuries may occur annually among all U.S. healthcare workers (both hospital-based workers and those in other health care settings). After percutaneous injury with a contaminated sharp instrument, the average risk of infection is 0.3% for HIV and ranges from 6% to 30% for HBV (NIOSH, 2004). On a positive note, the CDC has reported no new cases of occupationally-acquired HIV since 2001 (CDC, 2006).

During the period 1995-2000, there were 10,378 reported percutaneous injuries among hospital workers (NIOSH, 2004). The devices most associated with percutaneous injuries among hospital workers during 1995-2000 were hypodermic needles (29% of injuries), suture needles (17%), winged steel needles (12%), and scalpels (7%). Other hollow-bore needles together accounted for 19% of injuries, glass items for 2%, and other items for 14% (NIOSH, 2004).

During the period 1995-2000 there were 6,212 reported percutaneous injuries involving hollow-bore needles in hospital workers. Drawing blood from a vein (venipuncture) was responsible for 25% of percutaneous injuries involving hollow-bore needles during 1995-2000, and injections were responsible for 22% (NIOSH, 2004).

Recent research on a nationally representative sample utilizing data from the US Bureau of Labor Statistics, identified registered nurses as having the greatest frequency of needlestick injury (Leigh, et al., 2008); while the occupations with greatest risk of needlestick injury included biologic technicians, janitors and cleaners, and maids and housemen.

Other means of **sharps injury** can occur when 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.

Mucous membranes and non-intact skin exposures are also a potential method for exposure to bloodborne pathogens. Direct blood or body fluid contact with the eyes, nose, mouth or other mucous membranes occurs through contact with contaminated hands, contact with open skin lesions/dermatitis, or splashes/sprays of blood or body fluids such as might occur during irrigation or suctioning.

Parenteral exposures may occur through injection with infectious material while administering parenteral medications, sharing of blood monitoring devices such as glucometers, hemoglobinometers, lancets, lancet platforms/pens, or through the infusion of contaminated blood products or fluids.

Additional practice to prevent percutaneous exposures includes:

- Avoid unnecessary use of needles and other sharp objects.
- Use care in the handling and disposing of needles and other sharp objects.
- Avoid recapping unless absolutely medically necessary.
- When recapping, use only a one-hand technique or safety device.
- Pass sharp instruments by use of designated “safe zones”.
    - A “safe zone” is an area such as a tray or basin on the sterile field where an instrument is placed before being picked up by a second person. This can prevent “collision” injuries where OR personnel can be tuck by another when passing instruments.
- Disassemble sharp equipment by use of forceps or other devices.
- Modify procedures to avoid injury:
    - Use forceps, suture holders or other instruments for suturing.
    - Avoid holding tissue with fingers when suturing or cutting.
    - Avoid leaving exposed sharps of any kind on patient procedure/treatment work surfaces.
- Appropriately use safety devices whenever available:
    - Always activate safety features.

Never circumvent safety features.

<u>Safe Injection Practices and Procedures</u>

Outbreaks of healthcare-related bloodborne illness have occurred, usually due to unsafe injection practices. Recent news headlines that implicate specific healthcare organizations and specific healthcare providers for unsafe injection practices shocked the thousands of patients who may have had exposure to bloodborne pathogens, but such practices and procedures also shocked the broader healthcare community.

Injection safety or safe injection practices are 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.

The investigation of four large outbreaks of HBV and HCV among patients in ambulatory care facilities in the United States identified a need to define and reinforce safe injection practices (CDC, 2008b). The four outbreaks occurred in a private medical practice, a pain clinic, an endoscopy clinic, and a hematology/oncology clinic. The pain clinic was located on Long Island, New York. The primary breaches in infection control practice that contributed to these outbreaks were:

1. reinsertion of used needles into a multiple-dose vial or solution container (e.g., saline bag) and
2. use of a single needle/syringe to administer intravenous medication to multiple patients.

In one of these outbreaks, preparation of medications in the same workspace where used needle/syringes were dismantled also may have been a contributing factor. These and other outbreaks of viral hepatitis could have been prevented by adherence to basic principles of aseptic technique for the preparation and administration of parenteral medications. These include the use of a sterile, single-use, disposable needle and syringe for each injection given and prevention of contamination of injection equipment and medication.

The unsafe practices above have resulted in the transmission of bloodborne viruses, including hepatitis B and C viruses to patients; as well as the notification of thousands of patients of possible exposure to bloodborne pathogens and recommendation that they be tested for hepatitis C, hepatitis B virus, and HIV. Additionally, healthcare providers were referred to licensing boards for disciplinary action and multiple malpractice lawsuits were filed on behalf of patients.

Outbreaks related to unsafe injection practices indicate that some healthcare personnel are unaware of, do not understand, or do not adhere to basic principles of infection control and aseptic technique. A survey of US healthcare workers who provide medication through injection found that 1% to 3% reused the same needle and/or syringe on multiple patients. Among the deficiencies identified in recent outbreaks were a lack of oversight of personnel and failure to follow-up on reported breaches in infection control practices in ambulatory settings (CDC, 2008b).

It is important for to remember that pathogens including HCV, HBV, and human immunodeficiency virus (HIV) can be present in sufficient quantities to produce infection in the absence of visible blood. Bacteria and other microbes can be present without clouding or other visible evidence of contamination.

The absence of visible blood or signs of contamination in a used syringe, IV tubing, multi-dose medication vial, or blood glucose monitoring device does NOT mean the item is free from potentially infectious agents.

All used injection supplies and materials are potentially contaminated and should be discarded.

Providers should maintain **aseptic technique** throughout all aspects of injection preparation and administration, which includes the following:

- Medications should be drawn up in a designated "clean" medication area that is not adjacent to areas where potentially contaminated items are placed.
- Use a new sterile syringe and needle to draw up medications while preventing contact between the injection materials and the non-sterile environment.
- Ensure proper hand hygiene before handling medications.
- If a medication vial has already been opened, the rubber septum should be disinfected with alcohol prior to piercing it.
- Never leave a needle or other device (e.g. “spikes”) inserted into a medication vial septum or IV bag/bottle for multiple uses. This provides a direct route for microorganisms to enter the vial and contaminate the fluid.
- Medication vials should be discarded upon expiration or any time there are concerns regarding the sterility of the medication.
- 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.
    - All of the infusion components from the infusate to the patient's catheter are a single interconnected unit.
    - All of the components 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 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.
- 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 bags or bottles of intravenous solution as a common source of supply for more than one patient.
- Never use peripheral capillary blood monitoring devices packaged as single-patient use on more than one patient:
- Restrict use of peripheral capillary blood sampling devices to individual patients.
- Never reuse lancets. Consider selecting single-use lancets that permanently retract upon puncture.

Safe injection practices as identified in the CDC's *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007*.
include the following recommendations apply to the use of needles, cannulas that replace needles, and, where applicable intravenous delivery systems (CDC, 2007):

- Use aseptic technique to avoid contamination of sterile injection equipment.
- Do not administer medications from a syringe to multiple patients, even if the needle or cannula on the syringe is changed. Needles, cannulae and syringes are sterile, single-use items; they should not be reused for another patient nor to access a medication or solution that might be used for a subsequent patient.
- Use fluid infusion and administration sets (i.e., intravenous bags, tubing and connectors) for one patient only and dispose appropriately after use. Consider a syringe or needle/cannula contaminated once it has been used to enter or connect to a patient's intravenous infusion bag or administration set.
- Use single-dose vials for parenteral medications whenever possible.
- Do not administer medications from single-dose vials or ampules to multiple patients or combine leftover contents for later use.
- If multidose vials must be used, both the needle or cannula and syringe used to access the multidose vial must be sterile.
- Do not keep multidose vials in the immediate patient treatment area and store in accordance with the manufacturer's recommendations; discard if sterility is compromised or questionable.
- Do not use bags or bottles of intravenous solution as a common source of supply for multiple patients.

Surveillance/Evaluation

Each year an estimated 385,000 needlesticks and other sharps-related injuries are sustained by hospital-based healthcare personnel; an average of 1,000 sharps injuries per day (NIOSH, 2008). Healthcare providers who may be exposed to blood or other potentially infected material are at risk, particularly if they are exposed to contaminated needles or other contaminated sharps that may cause injury. In addition to the surveillance needed regarding the potential for injury to healthcare providers, similarly, surveillance is used to identify factors related to the 2 million HAIs per year.

Surveillance is defined as the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health (CDC, 2007). Multiple agencies require ongoing evaluation of potential hazards from bloodborne pathogens, including the Occupational Safety and Health Administration (OSHA), the Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH). In New York State, the Department of Health and each individual healthcare organization or facility has policies that support the safety of patients and healthcare providers, as well as identifying how and to whom HAIs are reported and analyzed.

A comprehensive standardized method for recording and tracking percutaneous injuries and blood and body fluid contact is the Exposure Prevention Information Network (EPINet). The EPINet system consists of a Needlestick and Sharp Object Injury Report and a Blood and Body Fluid Exposure Report, and software programmed in Access®* for entering and analyzing the data from the forms. (A post-exposure follow-up form is also available.) Since its introduction in 1992, more than 1,500 hospitals in the U.S. have acquired EPINet for

use; it has also been adopted in other countries, including Canada, Italy, Spain, Japan and U.K (EPINET, 2008). With this system, the following is available:

- Identify injuries that may be prevented with safer medical devices.
- Share and compare information and successful prevention measures with other institutions.
- Evaluate the efficacy of new devices designed to prevent injuries.
- Target high-risk devices and procedures for intervention.
- Analyze injury frequencies by attributes like jobs, devices, and procedures.
- Prepare monthly, quarterly, and annual exposure reports.

They can be accessed at http://www.healthsystem.virginia.edu/internet/epinet/about_epinet.cfm#What-is-EPINet.

While any sharp device can cause injury and has the potential for disease transmission, some devices have a higher disease transmission risk, such as hollow-bore needles. Other devices have higher injury rates, such as butterfly-type IV catheters and devices with recoil action, blood glucose monitoring devices with lancet platforms/pens. It is important to identify the settings in which exposures occur and the circumstances by which exposure is more likely to occur.

Safety and Health Controls

In order to comply with the safety standards and thereby protect the health and safety of healthcare providers and patients, a hierarchy of controls is utilized. **The hierarchy of safety and health controls include (CDC, 2004a):**

- Legal and regulatory controls.
- Administrative and Training controls.
- Engineering controls.
- Work practice controls.
- Personal protective equipment (this will be covered in Element IV of this training).

Legal and Regulatory Controls

The Occupational Safety and Health Administration (OSHA) **Occupational Safety and Health Act of 1970, General Duty Clause** requires that each employer:

1. Furnish to each employee employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to employees;
2. Complies occupational safety and health standards promulgated under this Act.

And each employee must comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to this Act.

In 1991 OSHA promulgated the **Occupational Exposure to Bloodborne Pathogens Standard**. This standard was designed to protect millions of healthcare workers and related occupations from the risk of exposure to blood or other potentially infectious materials. It has multiple components including the use of standard precautions (explained below in the work practice control section) and expanded transmission-based precautions, exposure determination (employers must identify all job classifications, as well as all tasks and procedures where exposure to bloodborne pathogens is possible as part of routine work).

A clear example of a legal control is the 2008 law that included physicians, physician assistants and specialist assistants as professionals who are legally required to adhere to scientifically accepted principles and practices of infection control. The previously mentioned incident of unsafe injection practices at a pain clinic on Long Island facilitated the creation of this law. Reportedly, the physician at this clinic had been under surveillance for years regarding his infection control practices and many of the 10,500 patients that were notified of possible exposure to bloodborne pathogens contracted HCV and HBV (USA Today, 2008). Unfortunately physicians

were not previously included in the legal requirement to utilize proper infection control; the 2008 law is a legal control that was enacted, at least in part, in response to this particular situation.

Administrative and Training Controls

Administrative and training controls include all of the policies and procedures related to infection control that each healthcare facility must provide to employees of that facility. These policies and procedures relate to any issue in the healthcare setting in which an employee would have to utilize proper infection controls practices. The training of employees regarding infection control issues are also a component of administrative controls, as each facility determines the need for training.

It is important to remember that some training controls are also a legal control, for example this course is a legislated requirement for licensed healthcare providers in New York State.

Engineering Controls

Engineering controls eliminate or reduce exposure to a threat such as a pathogen or physical hazard through the use or substitution of engineered machinery or equipment. Examples include needleless syringes, sharps disposal containers, self-sheathing needles, safer medical devices such as sharps with engineered injury protections and needleless systems, specialized requirements for heating, cooling and ventilation in areas that house infectious diseases (operating rooms, intensive care units) (CDC, 2003a), high-efficiency particulate air (HEPA) filtration, ultraviolet lights, safety interlocks, and splatter shields on medical equipment associated with risk prone procedures (e.g., locking centrifuge lids). Well-designed engineering controls eliminate human error thus giving the healthcare worker greater protection from the hazard.

Whenever possible, safer devices must be utilized in order to prevent sharps injuries. This includes the need to evaluate and select safer devices. Those healthcare providers who will be utilizing the safer device need to be involved in the process of decision making. It is preferable to utilize devices wherein the safety feature is integrated into the device, rather than one in which the safety equipment is an accessory device or one in which the healthcare provider must change practice habits (passive vs. active safety features). Safer devices that are specific to a particular clinical area or setting are ideal; devices that provide immediate and continuous protection are preferable. All staff who may utilize the new equipment or device must be educated as to the proper use of the device. Whenever possible, eliminate the traditional, or non-safety, alternative, so that staff must utilize the safer device.

Another example of an engineering control is the **puncture-resistant containers** for the disposal and transport of needles and other sharp objects.

Immediately or as soon as possible after use, **contaminated reusable sharps** must be placed in appropriate containers until properly reprocessed. These containers must be:

- Puncture resistant;
- Labeled or color-coded;
- Leakproof on the sides and bottom.

Single-use contaminated sharps shall be discarded immediately or as soon as feasible in containers that are:

- Closable;
- Puncture resistant;
- Leakproof on sides and bottom; and
- Labeled or color-coded.

During use, containers for contaminated sharps must be:

- Easily accessible to personnel and located as close as is feasible to the immediate area where sharps are used or can be reasonably anticipated to be found (e.g., laundries);
- Maintained upright throughout use; and
- Replaced routinely and not be allowed to overfill.

When moving containers of contaminated sharps from the area of use, the containers must be:

- Closed immediately prior to removal or replacement to prevent spillage or protrusion of contents during handling, storage, transport, or shipping;
- Placed in a secondary container if leakage is possible.

The second container shall be:

- Closable;
- Constructed to contain all contents and prevent leakage during handling, storage, transport, or shipping; and
- Labeled or color-coded.
- Reusable containers shall not be opened, emptied, or cleaned manually or in any other manner which would expose employees to the risk of percutaneous injury.

The New York State Department of Health (2007) addressed the used needles, syringes, and lancets used by millions of people at home during their routine health care. This public service pamphlet can be obtained from http://www.health.state.ny.us/publications/0909.pdf. It is aimed at preventing sharps injuries to family members and pets, preventing the sharps from being re-used or shared, and protecting the environment.

Sharps containers for the home can be bought at local drugstores, or alternatively a puncture-resistant bottle, such as a laundry bottle can be used. Instruct patients to screw the cap on tightly, apply tape over the cap and write "Contains Sharps" on the bottle. Instruct patients to put sharps into the container immediately after use and keep the container closed and away from children and pets and those who may be interested in re-using needles /syringes (NYSDOH, 2007).

Instruct patients to (NYSDOH, 2007):

- Never put the used sharps container in the trash.
- Never flush used sharps down the toilet or drop them into a sewer drain.
- Never clip, bend, or put the cap back on used sharps.
- Never put loose used sharps or your used sharps container in with the recyclables.
- Never use soda cans, milk cartons, glass bottles or containers that can be broken or punctured.
- Avoid coffee cans because the plastic lid easily comes off and may leak.

When the used sharps container is almost full, instruct patients to bring it to a safe disposal site:

- Some drugstores, health clinics, and community service agencies have large metal boxes (called *kiosks*) for sharps disposal. Call 1-800-541-2437 to find a kiosk near you.
- Used sharps can be brought to any hospital or nursing home in New York State. It is important to contact the facility to determine hours, days and location where used sharps can be brought.
- Call the New York State Department of Health at 1-800-522-5006 (Growing Up Healthy hotline) to find sharps disposal sites in your area. TTY: 1-800-655-1789. To find places with sharps disposal kiosks, call **1-800-541-2437.**
  For a list of disposal sites and kiosks by county, visit
  http://www.nyhealth.gov/diseases/aids/harm_reduction/needles_syringes/sharps/directory_sharpscollection.htm.

Another example of both an engineering control and a legal control, is the New York State law in 2000 that prohibited the use of sharps that do not incorporate engineered sharps injury protections with certain allowable exceptions when (NIOSH, 2002):

- appropriate engineered sharps are not available in the market;
- the use of sharps without engineered sharps injury protections is essential to the performance of a specific medical procedure; or
- based on objective product evaluation, sharps with engineered injury protections are not more effective in preventing exposure incidents than sharps without engineered injury protections.

This New York State law was in response to OSHA's revision of the Bloodborne Pathogen Standard (a federal law).

Work Practice Controls

Work practice controls relate to how work is done. They consist of multiple interventions which, when utilized properly, insure worker safety when engineering controls are not possible or available. Work practice controls alter the manner in which a task is performed, thereby reducing exposure to bloodborne pathogens (e.g., prohibiting recapping of needles by a two-handed technique).

Precautions are a set of infection control practices that healthcare personnel use to reduce transmission of microorganisms in healthcare settings. A very common work practice control is the use Standard Precautions.

- **Standard precautions** combine the major features of Universal Precautions (UP) and Body Substance Isolation (BSI) and are based on the principle that all blood, body fluids, secretions, excretions except sweat, nonintact skin, and mucous membranes may contain transmissible infectious agents. Standard Precautions include a group of infection prevention practices that apply to all patients, regardless of suspected or confirmed infection status, in any setting in which healthcare is delivered (CDC, 2007).

  These include: hand hygiene; use of gloves, gown, mask, eye protection, or face shield, depending on the anticipated exposure; and safe injection practices. Also, equipment or items in the patient environment likely to have been contaminated with infectious body fluids must be handled in a manner to prevent transmission of infectious agents (e.g., wear gloves for direct contact, contain heavily soiled equipment, properly clean and disinfect or sterilize reusable equipment before use on another patient). The application of Standard Precautions during patient care is determined by the nature of the healthcare worker-patient interaction and the extent of anticipated blood, body fluid, or pathogen exposure (CDC, 2007). Standard Precautions are also intended to protect patients by ensuring that healthcare personnel do not carry infectious agents to patients on their hands or via equipment used during patient care (CDC, 2007).

  The use of standard precautions assumes that the blood or body fluids of any person could be infectious, therefore personal protective equipment (PPE) may be needed as a barrier to transmission of infectious agents. Decisions about the use of PPE are determined by the type of interaction the healthcare worker has with the patient (CDC, 2004a).

  PPE for standard precautions include (CDC, 2002; CDC, 2004a; CDC, 2007):

    - **Gloves** when touching blood, body fluids, secretions, excretions, mucous membranes, non-intact skin, or contaminated surfaces and objects.
    - **Gowns** during procedures and patient care activities likely to generate splashes or sprays of blood/body fluids, secretions, or excretions; be careful to secure the gown fully and to remove it immediately after the procedure/care.
    - **Mask** during procedures that are likely to generate splashes or sprays of blood, bodily fluids, secretions, and excretions.
    - **Eye protection** during procedures and activities likely to generate splashes, sprays of blood, body fluids.
    - **Face shield** during patient care activities likely to generate splashes or sprays of blood, body fluids, secretions or excretions.

  According to the CDC's *Guidelines for Isolation Precautions: Preventing Transmission of Infectious Agents- 2007*, there are 3 additional components of Standard Precautions: Respiratory Hygiene/Cough Etiquette, safe injection practices, and use of masks for insertion of catheters or injection of material into spinal or epidural spaces via lumbar puncture procedures (e.g., myelogram, spinal or epidural anesthesia). While most elements of Standard Precautions evolved from Universal Precautions that were developed for protection of healthcare personnel, these new elements of Standard Precautions focus on protection of patients. Safe injection practices have been addressed previously in this course.

Respiratory Hygiene/Cough Etiquette grew out of the 2003 SARS outbreaks. The elements of Respiratory Hygiene/Cough Etiquette include 1) education of healthcare facility staff, patients, and visitors; 2) posted signs, in language(s) appropriate to the population served, with instructions to patients and accompanying family members or friends; 3) source control measures (e.g., covering the mouth/nose with a tissue when coughing and prompt disposal of used tissues, using surgical masks on the coughing person when tolerated and appropriate); 4) hand hygiene after contact with respiratory secretions; and 5) spatial separation, ideally >3 feet, of persons with respiratory infections in common waiting areas when possible. Covering sneezes and coughs and placing masks on coughing patients are proven means of source containment that prevent infected persons from dispersing respiratory secretions into the air. Masking may be difficult in some settings. These measures should be effective in decreasing the risk of transmission of pathogens contained in large respiratory droplets (CDC, 2007).

- **Expanded Precautions** include the following:
    - Contact Precautions
    - Droplet Precautions
    - Airborne Infection Isolation Room (AIIR) Precautions

PPE for contact precautions include: gowns and gloves for contact with patient or environment of care (e.g. medical equipment, environmental surfaces). In some instances gowns are required when entering a patient's environment.

PPE for droplet precautions: surgical masks within three to ten feet of patient (CDC, 2003; CDC, 2007).

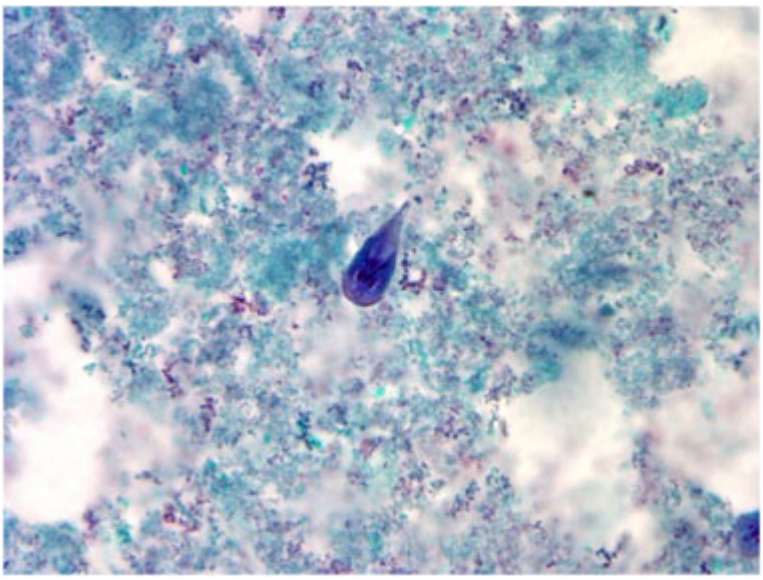
PPE for airborne precautions: particulate respirator. In addition negative pressure isolation room is also needed.

Cleaning of Blood and Body Fluid Spills

Promptly clean and decontaminate spills of blood or other potentially infectious materials. Initial removal of bulk material is followed by disinfection with an appropriate disinfectant

- Follow proper procedures for site decontamination of spills of blood or blood-containing body fluids:
    - Use protective gloves and other PPE appropriate for this task;
    - If the spill contains large amounts of blood or body fluids, clean the visible matter with disposable absorbent material, and discard the used cleaning materials in appropriate, labeled containers.
- Swab the area with a cloth or paper towels moderately wetted with disinfectant, and allow the surface to dry.
- Use germicides registered by the Environmental Protection Agency (EPA) for use as hospital disinfectants and labeled tuberculocidal or registered germicides on the EPA Lists D and E (i.e., products with specific label claims for HIV or HBV) in accordance with label instructions to decontaminate spills of blood and other body fluids.
- An EPA-registered sodium hypochlorite product is preferred, but if such products are not available, generic sodium hypochlorite solutions (e.g., household chlorine bleach) may be used:
    - Use a 1:100 dilution (500--615 ppm available chlorine) to decontaminate nonporous surfaces after cleaning a spill of either blood or body fluids in patient-care settings;
    - If a spill involves large amounts of blood or body fluids, or if a blood or culture spill occurs in the laboratory, use a 1:10 dilution (5,000--6,150 ppm available chlorine) for the first application of germicide before cleaning.

Element V of this course will further address the proper handling/disposal of blood and body fluids, decontamination of patient care items and work surfaces.



At a magnification of 1000X, this trichrome-stained photomicrograph revealed the morphologic characteristics of a blue-stained *Giardia intestinalis* protozoan trophozoite (center). Photo courtesy of CDC/ DPDx - Melanie Moser.

Element IV: Selection and use of barriers and or personal protective equipment for preventing patient and healthcare worker contact with potentially infection material.

Personal protective equipment (PPE) is defined by OSHA as specialized clothing or equipment worn by an employee for protection against infectious materials. They are selected based upon:

- Anticipated exposure type - splash/spray versus touch
- Category of isolation precaution
- Durability and appropriateness for the task
- Fit

As part of the Bloodborne Pathogen Standard, OSHA requires employers to provide appropriate PPE for employees. Employers must also ensure that PPE is disposed, or that reusable PPE is cleaned, laundered, repaired and stored after use. OSHA specifies the circumstances for which PPE is indicated; the CDC recommends when, what, and how to use PPE (CDC, 2007).

Types of PPE

- Gloves - protect hands
- Gowns/aprons - protect skin and/or clothing
- Masks and respirators - protect mouth/nose; respirators protect respiratory tract from airborne infectious agents
- Goggles - protect the eyes
- Face shields - protect face, mouth, nose and eyes

There are four key points to remember about PPE use:

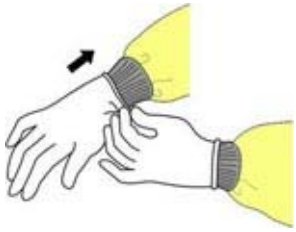
1. First, don it before any contact with the patient is made, generally before entering the room.
2. Once the PPE is on, use it carefully to prevent spreading contamination.
3. When tasks have been completed, remove the PPE carefully and discard it in the receptacles provided.
4. Then immediately perform hand hygiene before going on to the next patient.

Gloves

Gloves are used in patient care situations as well as for environmental services. They are made of vinyl, latex, nitrile and other materials. They are available in both sterile and non-sterile forms; some are made for single use, others are reusable. Healthcare workers sometimes wear a single pair of gloves; sometimes double gloving is utilized (CDC, 2007).

The procedure for donning gloves is:

- Select correct type and size; use non-sterile for isolation; select according to hand size.
- Insert hands into gloves.
- Extend gloves over isolation gown cuffs.



Do's and Don'ts of Glove Use (CDC, 2007):

- Work from "clean" to "dirty"
- Limit opportunities for "touch contamination"
- Protect yourself, others and the environment:
    - Don't touch your face or adjust PPE with contaminated gloves.
    - Don't touch environmental surfaces except as needed during patient care.
- Change gloves
    - During use if torn or heavily soiled (even when caring for the same patient).
    - After use on each patient.
- Discard in appropriate receptacle
    - Never wash or reuse disposable gloves.

The procedure for removing gloves is:

- Remove PPE at doorway before leaving patient room or in anteroom
- Outside of gloves are contaminated;
- Grab outside edge near wrist with opposite gloved hand;
- Peel away from hand, turning glove inside out;
- Hold removed glove in opposite gloved hand;
- Slide ungloved finger under the wrist of the remaining glove;
- Peel off from inside, creating a bag for both gloves;
- Discard.

Gowns and Aprons

Gowns and aprons can be made of natural materials or synthetic materials; they can be disposable or reusable; they vary in level of fluid resistance; they can be sterile or clean. Three factors influence the selection of a gown or apron. Firstly, the purpose of its use must be considered. Isolation gowns are generally the preferred PPE for clothing but aprons occasionally are used where limited contamination is anticipated. If contamination of the arms can be anticipated, a gown should be selected. Gowns should fully cover the torso, fit comfortably over the body, and have long sleeves that fit snuggly at the wrist.

Second are the material properties of the gown. Isolation gowns are made either of cotton or a spun synthetic material that dictate whether they can be laundered and reused or must be disposed. Cotton and spun synthetic isolation gowns vary in their degree of fluid resistance, another factor that must be considered in the selection of this garb. If fluid penetration is likely, a fluid resistant gown should be used.

The last factor concerns patient risks and whether a clean, rather than sterile gown, can be used. Clean gowns are generally used for isolation. Sterile gowns are only necessary for performing invasive procedures, such as inserting a central line. In this case, a sterile gown would serve to protect the patient and the healthcare provider.

The procedure for donning a gown is:

- Select appropriate type and size; fully cover torso from neck to knees, arms to end of wrist and wrap around the back;
- Opening is in the back;
- Secure at neck and waist;
- If gown is too small, wear 2 gowns:
    - Gown #1 ties in front.
    - Gown #2 ties in back.

The procedure for removing a gown is:

- Gown front and sleeves are contaminated;
- Unfasten ties at neck and then waist tie;
- Peel gown down away from neck and each shoulder toward the same had;
- Turn contaminated outside to the inside;
- Hold removed gown away from body;
- Fold or roll into a bundle;
- Discard in appropriate receptacle.

Face Protection

Masks protect the nose and mouth; they should fully cover the nose and mouth and prevent fluid penetration. They should fit snuggly over the nose and mouth, making masks with flexible nose pieces that are secured to the head with string ties or with elastic are preferable.

The procedure for applying a mask is:

- Pace over nose, mouth and chin;
- Fit flexible nose piece over nose bridge;
- Secure on head with ties or elastic;
- Fit snug to face and below chin;
- Adjust to fit.

For removal of a mask, use this procedure:

- Front of mask/respirator is contaminated – Do Not Touch;
- Grasp only bottom tie first, then top tie/elastic and remove;
- Discard in appropriate waste container.

Goggles protect the eyes; personal prescription lenses do not provide optimal eye protection and are NOT a substitute for goggles. They should fit snuggly over and around the eyes; antifog feature improves clarity.

Face shields protect the face, nose, eyes, mouth and eyes; they should cover the forehead, extend below the chin and wrap around side of face. When skin protection, in addition to mouth, nose, and eye protection, is needed or desired, for example, when irrigating a wound or suctioning copious secretions, a face shield can be used as a substitute to wearing a mask or goggles. The face shield should cover the forehead, extend below the chin, and wrap around the side of the face.

The procedure for donning eye and face protection is:

- Position goggles over eyes and secure the head using the earpieces or headband.
- Position face shield over face and secure on brow with headband.
- Adjust to fit comfortably.

The procedure for removing goggles or face shields is:

- Outside of goggles or face shield are contaminated;
- Handle by “clean” head band or grasp ear pieces with ungloved hand (see sequence of removing PPE later in this section of the course);
- Lift away from face;
- Place in designated receptacle for disposal or reprossessing.

Respiratory Protection

Purpose is to protect workers from inhalation of infectious aerosols (e.g. Mycobaterium tuberculosis).

Types of respiratory PPE include:

- Particulate respirators,
- Half- and full-face elastomeric respirators,
- Powered air purifying respirators (PAPR).

The procedure for donning a particulate respirator is:

- Select a fit tested respirator;
- Place over nose, mouth and chin;
- Fit flexible nose piece over bridge of nose;
- Secure on head with elastic;
- Adjust to fit;
- Perform a fit check:
    - Inhale - respirator should collapse.
    - Exhale - check for leakage around face.

Removing a particulate respirator entails the following procedure:

- Lift the bottom elastic over your head first;
- Then lift the top elastic;
- Discard.

Safe Work Practices

Key points about PPE:

- Don before contact with the patient, generally before entering the room.
- Use carefully - don't spread contamination.
- Keep hands away from face;
- Work from clean to dirty;
- Limit surfaces touched;
- Change when torn or heavily contaminated;
- Remove and discard carefully, either at the doorway or immediately outside the patient room; remove respirator outside room.
- Immediately perform hand hygiene.

Sequence for donning PPE:

The order in which PPE is donned, is based on the combination of needed PPE, although the following recommendations are made, the specific situation will determine which sequence is practical.

- Gown first,
- Mask or respirator,
- Goggles or face shield,
- Gloves.

Knowing the difference between "clean" and "contaminated" areas of PPE is key to effective protection.

Contaminated areas include:

- The outside front of the PPE; and any

- Areas of the PPE that have had or are likely to have been in contact with body sites, materials or environmental surfaces where the infectious organism may reside.

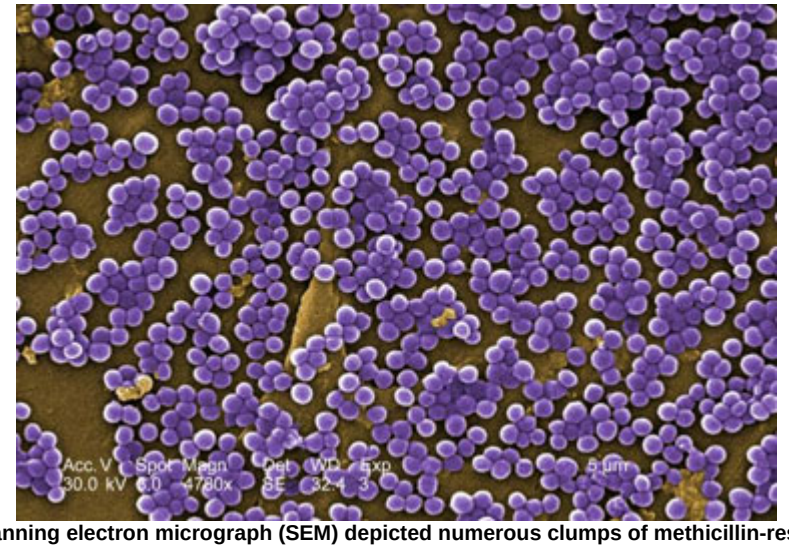
Clean areas include:

- The inside, outside back, ties on head and back; and any
- Areas of PPE not likely to have been in contact with infectious organisms.

The order in which PPE is removed also is important in maintaining protection. The sequence is:

- Gloves,
- Face shield or goggles,
- Gown,
- Mask or respirator.

PPE is best removed at the doorway of the patient room. An anteroom is ideally used; hand hygiene facilities (sink or alcohol-based hand rub) are to be in this location, where they will be needed.



This 2005 colorized scanning electron micrograph (SEM) depicted numerous clumps of methicillin-resistant *Staphylococcus aureus* bacteria, commonly referred to by the acronym, MRSA; Magnified 4780. Courtesy of CDC/ Janice Carr; Jeff Hageman. Photo courtesy of Janice Carr.

Element V: The creation and maintenance of a safe environment for patient care through application of infection control principles and practices for cleaning, disinfection, and sterilization.

The CDC released, in 2008, *Guidelines for Disinfection and Sterilization in Healthcare Facilities, 2008* (Rutala, et al., 2008). The following information is largely taken from that document.

Contamination involves the presence of microorganisms on an item or surface.

Cleaning is the removal of visible soil and foreign materials (e.g., organic and inorganic material such as dirt, body fluids, lubricants) from objects and surfaces and normally is accomplished manually or mechanically using water with soaps, detergents or enzymatic products, through washing or scrubbing the object or surface. Thorough cleaning is essential before high-level disinfection and sterilization because inorganic and organic materials that remain on the surfaces of instruments interfere with the effectiveness of these processes.

Decontamination involves the use of physical or chemical means to remove, inactive or destroy pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles. Decontamination removes pathogenic microorganisms from items so they are safe to handle, use, or discard.

Sterilization involves the removal or destruction of all microorganisms and their spores. *Sterilization* describes a process that destroys or eliminates all forms of microbial life and is carried out in health-care facilities by physical or chemical methods. Steam under pressure, dry heat, EtO gas, hydrogen peroxide gas plasma, and liquid chemicals are the principal sterilizing agents used in health-care facilities. Sterilization is intended to convey an absolute meaning; *unfortunately, however, some health professionals and the technical and commercial literature refer to "disinfection" as "sterilization" and items as "partially sterile." When chemicals are used to destroy all forms of microbiologic life, they can be called chemical sterilants. These same germicides used for shorter exposure periods also can be part of the disinfection process (i.e., high-level disinfection*).

Disinfection describes a process that eliminates many or all pathogenic microorganisms, except bacterial spores, on inanimate objects. In healthcare settings, objects usually are disinfected by liquid chemicals or wet pasteurization. Each of the various factors that affect the efficacy of disinfection can nullify or limit the efficacy of the process. Factors that affect the efficacy of both disinfection and sterilization include prior cleaning of the object; organic and inorganic load present; type and level of microbial contamination; concentration of and exposure time to the germicide; physical nature of the object (e.g., crevices, hinges, and lumens); presence of biofilms; temperature and pH of the disinfection process; and in some cases, relative humidity of the sterilization process (e.g., ethylene oxide).

- **High-level** disinfection is capable of killing all organisms, except high levels of bacterial spores, and is effected with a chemical germicide cleaned for marketing as a sterilant by the FDA.
- **Intermediate level** agent destroys all vegetative bacteria, including tubercle bacilli, lipid and some nonlipid viruses, and fungi, but not bacterial spores. These agents are registered as "tuberculocidal" by the US Environmental Protection Agency (EPA).
- **Low-level** agent is one that destroys all vegetative bacteria (except tubercle bacilli), lipid viruses, some nonlipid viruses, and some fungi, but not bacterial spores. These agents are registered as a hospital disinfectant by the EPA.

The CDC Guidelines utilize the Spaulding classification, which divides instruments and items for patient care into critical, semicritical or non-critical items. Depending on the category, planning for disinfection or sterilization can be determined for the most part.

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- **Non-critical items** are those that come in contact with intact skin but not mucous membranes. Intact skin acts as an effective barrier to most microorganisms; therefore, the sterility of items coming in contact with intact skin is "not critical." In the CDC Guideline, noncritical items are divided into noncritical patient care items and noncritical environmental surfaces. Examples of **noncritical patient-care items** are bedpans, blood pressure cuffs, crutches and computers. In contrast to critical and some semicritical items, most noncritical reusable items may be decontaminated where they are used and do not need to be transported to a central processing area. Virtually no risk has been documented for transmission of infectious agents to patients through noncritical items when they are used as noncritical items and do not contact non-intact skin and/or mucous membranes. Most Environmental Protection Agency (EPA)-registered disinfectants have a 10-minute label claim. Federal law requires all applicable label instructions on EPA-registered products to be followed: use-dilution, shelf life, storage, material compatibility, safe use, and disposal.

  Noncritcal environmental surfaces include bed rails, some food utensils, bedside tables, patient furniture and floors. Noncritical environmental surfaces frequently touched by hand (e.g., bedside tables, bed rails) potentially could contribute to secondary transmission by contaminating hands of healthcare workers or by contacting medical equipment that subsequently contacts patients. Mops and reusable cleaning cloths are regularly used to achieve low-level disinfection on environmental surfaces. However, they often are not adequately cleaned and disinfected, and if the water-disinfectant mixture is not changed regularly (e.g., after every three to four rooms, at no longer than 60-minute intervals), the mopping procedure actually can spread heavy microbial contamination throughout the healthcare facility. In one study, standard laundering provided acceptable decontamination of heavily contaminated mopheads but chemical disinfection with a phenolic was less effective. Frequent laundering of mops

(e.g., daily), therefore, is recommended. Single-use disposable towels impregnated with a disinfectant also can be used for low-level disinfection when spot-cleaning of noncritical surfaces is needed.

- **Semicritical items** contact mucous membranes or nonintact skin. This category includes respiratory therapy and anesthesia equipment, some endoscopes, laryngoscope blades, esophageal manometry probes, cystoscopes, anorectal manometry catheters, and diaphragm fitting rings. These medical devices should be free from all microorganisms; however, small numbers of bacterial spores are permissible. Intact mucous membranes, such as those of the lung and the gastrointestinal tract, generally are resistant to infection by common bacterial spores but susceptible to other organisms, such as bacteria, mycobacteria, and viruses.

  Semicritical items minimally require high-level disinfection using chemical disinfectants. Glutaraldehyde, hydrogen peroxide, ortho-phthataldehyde, and peracetic acid with hydrogen peroxide are cleared by the Food and Drug Administration (FDA) and are dependable high-level disinfectants provided the factors influencing germicidal procedures are met. When a disinfectant is selected for use with certain patient-care items, the chemical compatibility after extended use with the items to be disinfected also must be considered. Semicritical items minimally require high-level disinfection using chemical disinfectants.

- **Critical items** are those that enter sterile tissue or the vascular system and must be sterile. Critical items have a high risk for infection if they are contaminated with any microorganism. This category includes surgical instruments, cardiac and urinary catheters, implants, and ultrasound probes used in sterile body cavities.

  Most of the items in this category should be purchased as sterile or be sterilized with steam if possible. Heat-sensitive objects can be treated with ethylene oxide (EtO), hydrogen peroxide gas plasma; or if other methods are unsuitable, by liquid chemical sterilants. Germicides categorized as chemical sterilants include >/=2.4% glutaraldehyde-based formulations, 0.95% glutarldehyde with 1.54% phenol/phenate. 7.5% stabilized hydrogen peroxide, 7.35% hydrogen peroxide with 0.23% peracetic acid, 0.2% peracetic acid, and 0.08% peracetic acid with 1.0% hydrogen peroxide. Liquid chemical sterilants reliably produce sterility only if cleaning precedes treatment and if proper guidelines are followed regarding concentration, contact time, temperature, and pH.

The CDC, in the Guidelines, identifies the limitation of the Spaulding classification system with complicated medical equipment, particularly with complicated medical equipment and those that are in the semi-critical category. Choosing the best method for disinfection/sterilization can be difficult. According to the Guidelines (2008, p. 13):

This is true particularly for a few medical devices (e.g., arthroscopes, laparoscopes) in the critical category because of controversy about whether they should be sterilized or high-level disinfected. Heat-stable scopes (e.g., many rigid scopes) should be steam sterilized. Some of these items cannot be steam sterilized because they are heat-sensitive; additionally, sterilization using ethylene oxide (EtO) can be too time-consuming for routine use between patients (new technologies, such as hydrogen peroxide gas plasma and peracetic acid reprocessors, provide faster cycle times). However, evidence that sterilization of these items improves patient care by reducing the infection risk is lacking. Many newer models of these instruments can withstand steam sterilization, which for critical items is the preferred method.

Another problem with implementing the Spaulding scheme is processing of an instrument in the semicritical category (e.g., endoscope) that would be used in conjunction with a critical instrument that contacts sterile body tissues. For example, is an endoscope used for upper gastrointestinal tract investigation still a semicritical item when used with sterile biopsy forceps or in a patient who is bleeding heavily from esophageal varices? Provided that high-level disinfection is achieved, and all microorganisms except bacterial spores have been removed from the endoscope, the device should not represent an infection risk and should remain in the semicritical category . Infection with spore-forming bacteria has not been reported from appropriately high-level disinfected endoscopes.

An additional problem with implementation of the Spaulding system is that the optimal contact time for high-level disinfection has not been defined or varies among professional organizations, resulting in different strategies for disinfecting different types of semicritical items (e.g., endoscopes, applanation tonometers, endocavitary

transducers, cryosurgical instruments, and diaphragm fitting rings). Until simpler and effective alternatives are identified for device disinfection in clinical settings, following this guideline, other CDC guidelines and FDA-cleared instructions for the liquid chemical sterilants/high-level disinfectants would be prudent."

Recent Changes in Disinfection/Sterilization Reflected in the 2008 Guidelines

1. Formaldehyde-alcohol has been deleted as a recommended chemical sterilant or high-level disinfectant because it is irritating and toxic and not commonly used.
2. Several new chemical sterilants have been added, including hydrogen peroxide, peracetic acid and peracetic acid and hydrogen peroxide in combination.
3. Three percent phenolics and iodophors have been deleted as high-level disinfectants because of their unproven efficacy against bacterial spores, *M. tuberculosis*, and/or some fungi.
4. Isopropyl alcohol and ethyl alcohol have been excluded as high-level disinfectants 15 because of their inability to inactivate bacterial spores and because of the inability of isopropyl alcohol to inactivate hydrophilic viruses (i.e., poliovirus, coxsackie virus).
5. Reiteration/clarification of the need to high-level disinfect items such as vaginal endoscopes and ENT scopes between each patient use even if a protective sheath is used.
6. A 1:16 dilution of 2.0% glutaraldehyde-7.05% phenol-1.20% sodium phenate (which contained 0.125% glutaraldehyde, 0.440% phenol, and 0.075% sodium phenate when diluted) has been deleted as a high-level disinfectant because this product was removed from the marketplace in December 1991 because of a lack of bactericidal activity in the presence of organic matter; a lack of fungicidal, tuberculocidal and sporicidal activity; and reduced virucidal activity.
7. The exposure time required to achieve high-level disinfection has been changed from 10-30 minutes to 12 minutes or more depending on the FDA-cleared label claim and the scientific literature. A glutaraldehyde and an ortho-phthalaldehyde have an FDA-cleared label claim of 5 minutes when used at 35 degrees C and 25 degreesC, respectively, in an automated endoscope reprocessor with FDA-cleared capability to maintain the solution at the appropriate temperature.
8. Many new subjects have been added to the 2008 Guideline. These include inactivation of emerging pathogens, bioterrorist agents, and bloodborne pathogens; toxicologic, environmental, and occupational concerns associated with disinfection and sterilization practices; disinfection of patient-care equipment used in ambulatory and home care; inactivation of antibiotic-resistant bacteria; new sterilization processes, such as hydrogen peroxide gas plasma and liquid peracetic acid; and disinfection of complex medical instruments (e.g., endoscopes). For more detailed information about disinfection/sterilization of specific medical equipment, or other topics related to this content consult the complete Guideline at http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/Disinfection_Nov_2008.pdf.

OSHA's Bloodborne Pathogens Standard

OSHA's Bloodborne Pathogens Standard is aimed at eliminating or minimizing occupational exposure to bloodborne pathogens. One component of Standard is that all equipment and environmental and working surfaces be cleaned and decontaminated with an appropriate disinfectant after contact with blood or other potentially infectious materials. Even though the OSHA standard does not specify the type of disinfectant or procedure, the OSHA original compliance document suggested that a germicide must be tuberculocidal to kill the HBV. To follow the OSHA compliance document a tuberculocidal disinfectant (e.g., phenolic, and chlorine) would be needed to clean a blood spill. However, in February 1997, OSHA amended its policy and stated that EPA-registered disinfectants labeled as effective against HIV and HBV would be considered as appropriate disinfectants ". . . provided such surfaces have not become contaminated with agent(s) or volumes of or concentrations of agent(s) for which higher level disinfection is recommended."

When bloodborne pathogens other than HBV or HIV are of concern, OSHA continues to require use of EPA-registered tuberculocidal disinfectants or hypochlorite solution (diluted 1:10 or 1:100 with water). Studies demonstrate that, in the presence of large blood spills, a 1:10 final dilution of EPA-registered hypochlorite solution initially should be used to inactivate bloodborne viruses to minimize risk for infection to healthcare personnel from percutaneous injury during cleanup.

Potential for contamination is dependent upon:

- Type of instrument, medical device, equipment, or environmental surface.
- Potential for external contamination (e.g., presence of hinges, crevices).

- Potential for internal contamination (e.g., presence of lumens).
- Physical composition, design, or configuration of the instrument, medical device, equipment, or environmental surface.
- Frequency of hand contact with instrument medical device, equipment, or environmental surface. Potential for contamination with body substances or environmental sources of microorganisms.
- Level of contamination is dependent upon:
    - Types of microorganisms
    - Number of microorganisms
    - Potential for cross-contamination

Cleaning and Disinfecting Strategies for Environmental Surfaces in Patient-Care Areas

- Select EPA-registered disinfectants, if available, and use them in accordance with the manufacturer's instructions.
- Do not use high-level disinfectants/liquid chemical sterilants for disinfection of either noncritical instruments and devices or any environmental surfaces; such use is counter to label instructions for these toxic chemicals.
- Follow manufacturers' instructions for cleaning and maintaining noncritical medical equipment.
- In the absence of a manufacturer's cleaning instructions, follow certain procedures:
    - Clean noncritical medical equipment surfaces with a detergent/disinfectant. This may be followed by an application of an EPA-registered hospital disinfectant with or without a tuberculocidal claim (depending on the nature of the surface and the degree of contamination), in accordance with germicide label instructions.
    - Do not use alcohol to disinfect large environmental surfaces.
    - When using a pre-moistened/pre-mixed detergent/disinfectant wipe, use enough sheets to ensure that the surface area remains visibly wet for the contact time required for that product.
    - Use barrier protective coverings as appropriate for noncritical surfaces that are:
        - touched frequently with gloved hands during the delivery of patient care;
        - likely to become contaminated with blood or body substances; or
        - difficult to clean (e.g., computer keyboards).
- Keep housekeeping surfaces (e.g., floors, walls, tabletops) visibly clean on a regular basis and clean up spills promptly.
    - Use a one-step process and an EPA-registered hospital detergent/ disinfectant designed for general housekeeping purposes in patient-care areas where:
        - Uncertainty exists as to the nature of the soil on the surfaces (e.g., blood or body fluid contamination versus routine dust or dirt); or
        - Uncertainty exists regarding the presence of multidrug resistant organisms on such surfaces.
    - Detergent and water are adequate for cleaning surfaces in nonpatient-care areas (e.g., administrative offices).
    - Clean and disinfect high-touch surfaces (e.g., doorknobs, bed rails, light switches, and surfaces in and around toilets in patients' rooms) on a more frequent schedule than minimal-touch housekeeping surfaces.
    - Clean walls, blinds, and window curtains in patient-care areas when they are visibly dusty or soiled.
- Do not perform disinfectant fogging in patient-care areas.
- Avoid large-surface cleaning methods that produce mists or aerosols, or disperse dust in patient-care areas.
- Follow proper procedures for effective uses of mops, cloths, and solutions:
    - Prepare cleaning solutions daily or as needed, and replace with fresh solution frequently according to facility policies and procedures.
    - Change the mop head at the beginning of each day and also as required by facility policy, or after cleaning up large spills of blood or other body substances.
    - Clean mops and cloths after use and allow to dry before reuse; or use single-use, disposable mop heads and cloths. After the last surgical procedure of the day or night, wet vacuum or mop operating room floors with a single-use mop and an EPA-registered hospital disinfectant.
- After the last surgical procedure of the day or night, wet vacuum or mop operating room floors with a single-use mop and an EPA-registered hospital disinfectant.
- Do not use mats with tacky surfaces at the entrances to operating rooms or infection-control suites.

- Use appropriate dusting methods for patient-care areas designated for immunocompromised patients (e.g., HSCT patients).
  - Wet-dust horizontal surfaces daily by moistening a cloth with a small amount of an EPA-registered hospital detergent/disinfectant.
  - Avoid dusting methods that disperse dust (e.g., feather-dusting).
- Keep vacuums in good repair and equip vacuums with HEPA filters for use areas with patients at risk.
- Close the doors of immunocompromised patients' rooms when vacuuming, waxing, or buffing corridor floors to minimize exposure to airborne dust.
- When performing low- or intermediate-level disinfection of environmental surfaces in nurseries and neonatal units, avoid unnecessary exposure of neonates to disinfectant residues on these surfaces by using EPA-registered germicides in accordance with manufacturers' instructions and safety advisories.
  - Do not use phenolics or any other chemical germicide to disinfect bassinets or incubators during an infant's stay.
  - Rinse disinfectant-treated surfaces, especially those treated with phenolics, with water.
  - When using phenolic disinfectants in neonatal units, prepare solutions to correct concentrations in accordance with manufacturers' instructions, or use premixed formulations.

Reprocessing

Universal Principles

Instruments, medical devices and equipment should be managed and reprocessed according to recommended/appropriate methods regardless of a patient's diagnosis except for cases of suspected **prion** disease.

Special procedures are required for handling brain, spinal, or nerve tissue from patients with known or suspected prion disease (e.g., Creutzfeldt-Jakob disease [CJD]). Consultation with infection control experts prior to performing procedures on such patients is warranted.

Industry guidelines as well as equipment and chemical manufacturer recommendations should be used to develop and update reprocessing policies and procedures.

Written instructions should be available for each instrument, medical device, and equipment reprocessed.

Steps of Reprocessing

- Pre-cleaning Removes soil, debris, lubricants from internal and external surfaces; to be done as soon as possible after use
- Cleaning
  - Manual (e.g., scrubbing with brushes)
  - Mechanical (e.g., automated washers)
- Appropriate use and reprocessing of cleaning equipment (e. g., do not reuse disposable cleaning equipment)
- Frequency of solution changes
- Disinfection- requires sufficient contact time with chemical solution
- Sterilization- requires sufficient exposure time to heat, chemicals, or gases

Choice/Level of reprocessing sequence

- Based on intended use (see Definitions):
  - Critical instruments and medical devices require sterilization.
  - Semi critical instruments and medical devices minimally require high level disinfection.
  - Noncritical instruments and medical devices minimally require cleaning and low level disinfection.
- Based on manufacturer's recommendations
  - Compatibility among equipment components, materials, and chemicals used
  - Equipment heat and pressure tolerance
  - Time and temperature requirements for reprocessing

The effectiveness of reprocessing instruments, medical devices and equipment is dependent on:

- Cleaning prior to disinfection
- Disinfection
    - Selection and use of disinfectants-use of surface products or immersion products
    - Presence of organic matter
    - Presence of biofilms
    - Monitoring, including activity and stability of disinfectant, contact time with internal and external components, record keeping/tracking of instrument usage and reprocessing
    - Post-disinfection handling and storage
- Sterilization
    - Selection and use of methods
    - Monitoring – biologic monitors, process monitors (tape, indicator strips, etc.), physical monitors (pressure, temperature gauges), record keeping and recall/tracking system for each sterilization processing batch/item
    - Post-sterilization handling, packaging and storage (event-related criteria)

It is important to recognize potential sources of cross-contamination in the healthcare environment:

- Surfaces or equipment which require cleaning between patient procedures/treatments
- Practices that contribute to hand contamination and the potential for cross-contamination
- Consequences of reuse of single-use/disposable instruments, medical devices or equipment

At any point in reprocessing or handling, breaks in infection control practices can compromise the integrity of instruments, medical devices or equipment. Some specific factors have contributed to contamination in reported cases of disease transmission include:

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

<u>Provider Practice Setting and Need for Detailed Reprocessing Information</u>
The individual healthcare provider's area of professional practice setting and scope of responsibilities determines the need for more information regarding infection control and disinfection/sterilization.

For professionals who practice in settings where handling, cleaning, and reprocessing equipment, instruments or medical devices is performed elsewhere (e.g., in a dedicated Sterile Processing Department), it is important to understand core concepts and principles of infection control, including:

- Standard and Universal Precautions (e.g., wearing of personal protective equipment);
- Cleaning, disinfection, and sterilization described in Sections III and IV above;
- Appropriate application of safe practices for handling instruments, medical devices and equipment in the area of professional practice;
- Designation and physical separation of patient care areas from cleaning and reprocessing areas is strongly recommended by NYSDOH;
- Verify with those responsible for reprocessing what steps are necessary prior to submission regarding pre-cleaning, soaking, etc.

For professionals who have primary or supervisory responsibilities for equipment, instruments or medical device reprocessing (e.g., Sterile Processing Department staff or clinics and physician practices where medical equipment is reprocessed on-site):

- Understand core concepts and principles
    - Standard and Universal Precautions
    - Cleaning, disinfection, and sterilization described in Sections III and IV above
    - Appropriate application of safe practices for handling instruments, medical devices, and equipment in the area of professional practice

    - Designation and physical separation of patient care areas from cleaning and reprocessing areas is strongly recommended by NYSDOH.
- Determine appropriate reprocessing practices and the selection of appropriate methods, taking into consideration:
    - Antimicrobial efficacy
    - Time constraints and requirements for various methods
    - Compatibility among equipment/materials, including factors such as corrosiveness, penetrability, leaching, disintegration, heat tolerance and moisture sensitivity.
    - Toxicity, including occupational health risks, environmental hazards, abatement methods, monitoring exposures, potential for patient toxicity/allergy
    - Residual effect, including antibacterial residual, patient toxicity/allergy
    - Ease of use, is there a need for specialized equipment or are there special training requirements
    - Stability, concentration, potency, efficacy of use, rffect of organic material
    - Odor
    - Cost
    - Monitoring frequency

For more information regarding FDA regulations for reprocessing single use devices refer to the FDA web site at: http://www.fda.gov/cdrh/reprocessing

Table 1. Summary of advantages and disadvantages of chemical agents used as chemical sterilants1 or as high-level disinfectants.

Sterilization Method	Advantages	Disadvantages
Peracetic Acid/Hydrogen Peroxide	• No activation required • odor or irritation not significant	• Materials compatibility concerns (lead, brass, copper, zinc) both cosmetic and functional • Limited clinical experience • Potential for eye and skin damage
Glutaraldehyde	• Numerous use studies published • Relatively inexpensive • Excellent materials compatibility	• Respiratory irritation from glutaraldehyde vapor • Pungent and irritating odor • Relatively slow mycobactericidal activity • Coagulates blood and fixes tissue to surfaces • Allergic contact dermatitis • Glutaraldehyde vapor monitoring recommended
Hydrogen Peroxide	• No activation required • May enhance removal of organic matter and organisms • No disposal issues • No odor or irritation issues • Does not coagulate blood or fix tissues to surfaces • Inactivates *Cryptosporidium* • Use studies published	• Material compatibility concerns (brass, zinc, copper, and nickel/silver plating) • both cosmetic and functional • Serious eye damage with contact
Ortho-phthalaldehyde	• Fast acting high-level disinfectant • No activation required • Odor not significant • Excellent materials compatibility claimed • Does not coagulate blood or fix tissues to surfaces claimed	• Stains skin, mucous membranes, clothing, and environmental surfaces • Repeated exposure may result in hypersensitivity in some patients with bladder cancer • More expensive than glutaraldehyde • Eye irritation with contact • Slow sporicidal activity
Peracetic Acid	• Rapid sterilization cycle time (30-45 minutes) • Low temperature (50-55oC) liquid immersion sterilization • Environmental friendly by-products (acetic acid, O2, H20) • Fully automated • Single-use system eliminates need for concentration testing • Standardized cycle • May enhance removal of organic material and endotoxin • No adverse health effects to operators under normal operating conditions • Compatible with many materials and instruments • Does not coagulate blood or fix tissues to surfaces • Sterilant flows through scope facilitating salt, protein, and microbe removal • Rapidly sporicidal • Provides procedure standardization (constant dilution, perfusion of channel, temperatures, exposure)	• Potential material incompatibility (e.g., aluminum anodized coating becomes dull) • Used for immersible instruments only • Biological indicator may not be suitable for routine monitoring • One scope or a small number of instruments can be processed in a cycle • More expensive (endoscope repairs, operating costs, purchase costs) than • high-level disinfection • Serious eye and skin damage (concentrated solution) with contact • Point-of-use system, no sterile storage

1All products effective in presence of organic soil, relatively easy to use, and have a broad spectrum of antimicrobial activity (bacteria, fungi, viruses, bacterial spores, and mycobacteria). The above characteristics are documented in the literature; contact the manufacturer of the instrument and sterilant for additional information. All products listed above are FDA-cleared as chemical sterilants except OPA, which is an FDA-cleared high-level disinfectant.

Table 2. Summary of advantages and disadvantages of commonly used sterilization Technologies.

Sterilization Method	Advantages	Disadvantages
Steam	• Nontoxic to patient, staff, environment • Cycle easy to control and monitor • Rapidly microbicidal • Least affected by organic/inorganic soils among sterilization processes listed • Rapid cycle time • Penetrates medical packing, device lumens	• Deleterious for heat-sensitive instruments • Microsurgical instruments damaged by repeated exposure • May leave instruments wet, • causing them to rust • Potential for burns
Hydrogen Peroxide Gas Plasma	• Safe for the environment • Leaves no toxic residuals • Cycle time is 28-75 minutes (varies with model type) and no aeration necessary • Used for heat- and moisture-sensitive items since process temperature <50oC • Simple to operate, install (208 V outlet), and monitor • Compatible with most medical devices • Only requires electrical outlet	• Cellulose (paper), linens and liquids cannot be processed • Sterilization chamber size from 1.8-9.4 ft3 total volume (varies with model type) • Some endoscopes or medical devices with long or narrow lumens cannot be processed at this time in the United States (see manufacturer's recommendations for internal diameter and length restrictions) • Requires synthetic packaging (polypropylene wraps, polyolefin pouches) and special container tray • Hydrogen peroxide may be toxic at levels greater than 1 ppmTWA
100% Ethylene Oxide (ETO)	• Penetrates packaging materials, device lumens • Single-dose cartridge and negative-pressure chamber minimizes the potential for gas leak and ETO exposure • Simple to operate and monitor • Compatible with most medical materials	• Requires aeration time to remove ETO residue • Sterilization chamber size from 4.0-7.9 ft3 total volume (varies with model type) • ETO is toxic, a carcinogen, and flammable • ETO emission regulated by states but catalytic cell removes 99.9% of ETO and converts it to CO2 and H2O • ETO cartridges should be stored in flammable liquid storage cabinet • Lengthy cycle/aeration time
ETO Mixtures 8.6% ETO/91.4% HCFC 10% ETO/90% HCFC 8.5% ETO/91.5% CO2	• Penetrates medical packaging and many plastics • Compatible with most medical materials • Cycle easy to control and monitor	• Some states (e.g., CA, NY, MI) require ETO emission reduction of 90-99.9% • CFC (inert gas that eliminates explosion hazard) banned in 1995 • Potential hazards to staff and patients • Lengthy cycle/aeration time • ETO is toxic, a carcinogen, and flammable
Peracetic Acid	• Rapid cycle time (30-45 minutes) • Low temperature (50-55oC liquid immersion sterilization • Environmental friendly by-products • Sterilant flows through endoscope which facilitates salt, protein and microbe removal	• Point-of-use system, no sterile storage • Biological indicator may not be suitable for routine monitoring • Used for immersible instruments only • Some material incompatibility (e.g., aluminum anodized coating becomes dull) • One scope or a small number of instruments processed in a cycle • Potential for serious eye and skin damage (concentrated solution) with contact
Abbreviations: CFC=chlorofluorocarbon, HCFC=hydrochlorofluorocarbon.		

Regulated Medical Waste

Categories of Regulated Medical Waste

- Designate the following as major categories of medical waste that require special handling and disposal precautions:
    - microbiology laboratory wastes [e.g., cultures and stocks of microorganisms];
    - bulk blood, blood products, blood, and bloody body fluid specimens;
    - pathology and anatomy waste; and
    - sharps [e.g., needles and scalpels]
- Consult federal, state, and local regulations to determine if other waste items are considered regulated medical wastes.

Disposal Plan for Regulated Medical Wastes

- Develop a plan for the collection, handling, predisposal treatment, and terminal disposal of regulated medical wastes.
- Designate a person or persons as responsible for establishing, monitoring, reviewing, and administering the plan.

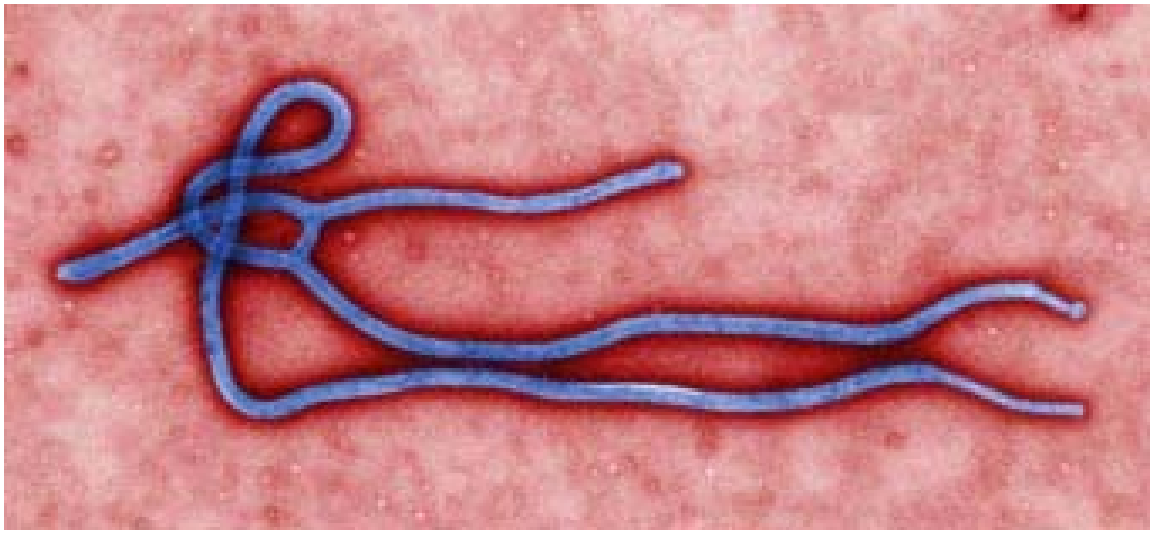
Handling, Transporting, and Storing Regulated Medical Wastes

- Inform personnel involved in handling and disposal of potentially infective waste of possible health and safety hazards; ensure that they are trained in appropriate handling and disposal methods.
- Manage the handling and disposal of regulated medical wastes generated in isolation areas by using the same methods used for regulated medical wastes from other patient-care areas.
- Use proper sharps disposal strategies:
    - Use a sharps container capable of maintaining its impermeability after waste treatment to avoid subsequent physical injuries during final disposal.
    - Place disposable syringes with needles, including sterile sharps that are being discarded, scalpel blades, and other sharp items into puncture-resistant containers located as close as practical to the point of use.
    - Do not bend, recap, or break used syringe needles before discarding them into a container.
- Store regulated medical wastes awaiting treatment in a properly ventilated area inaccessible to vertebrate pests; use waste containers that prevent development of noxious odors.
- If treatment options are not available at the site where the medical waste is generated, transport regulated medical wastes in closed, impervious containers to the on-site treatment location or to another facility for treatment as appropriate.

Treatment and Disposal of Regulated Medical Wastes

- Treat regulated medical wastes by using a method (e.g., steam sterilization, incineration, interment, or an alternative treatment technology) approved by the appropriate authority having jurisdiction (e.g., state, Indian Health Service, or Veterans Administration) before disposal in a sanitary landfill.
- Follow precautions for treating microbiologic wastes (e.g., amplified cultures and stocks of microorganisms):
    - Biosafety level 4 laboratories must inactivate microbiologic wastes in the laboratory by using an approved inactivation method (e.g., autoclaving) before transport to and disposal in a sanitary landfill.
    - Biosafety level 3 laboratories must inactivate microbiologic wastes in the laboratory by using an approved inactivation method (e.g., autoclaving) or incinerate them at the facility before transport to and disposal in a sanitary landfill.
- Biosafety levels 1 and 2 laboratories should develop strategies to inactivate amplified microbial cultures and stocks onsite by using an approved inactivation method (e.g., autoclaving) instead of packaging and shipping untreated wastes to an offsite facility for treatment and disposal.
- Laboratories that isolate select agents from clinical specimens must comply with federal regulations for receipt, transfer, management, and appropriate disposal of these agents.

- Sanitary sewers may be used for safe disposal of blood, suctioned fluids, ground tissues, excretions, and secretions, provided that local sewage discharge requirements are met and that the state has declared this to be an acceptable method of disposal.



This colorized transmission electron micrograph (TEM) revealed some of the ultrastructural morphology displayed by an Ebola virus virion. Photo courtesy of CDC/Cynthia Goldsmith.

Element VI: The prevention and management of infectious or communicable disease in healthcare workers.

Because of their contact with patients or infective material from patients, environmental services and facility visitors, healthcare workers and healthcare organizations utilize multiple interventions to prevent and/or manage infections in healthcare workers.

Initially, new employees are generally required to have a pre-employment physical; presumably any infection can be identified at that time and treatment initiated or management strategies employed prior to contact with patients or coworkers. Because healthcare workers are at risk for exposure to and possible transmission of vaccine-preventable diseases, maintenance of immunity is an essential part of prevention and infection control 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.

On the basis of documented transmission, healthcare workers are considered to be at significant risk for acquiring or transmitting (CDC, 1997):

- Hepatitis B,
- Influenza,
- Measles,
- Mumps,
- Rubella, and
- Varicella.

All of these diseases are vaccine-preventable. The Advisory Committee on Immunization Practices (ACIP) has developed an adult immunization schedule for October 2007 - November 2008 (ACIP, 2007). This schedule can be found by visiting http://www.cdc.gov/vaccines/recs/schedules/adult-schedule.htm.

In addition to pre-employment screening or testing for infection and illness, vaccinations for vaccine-preventable illnesses, maintenance of good health, and the utilization of engineering and work practice controls are all methods to minimize the risk of acquiring or transmitting an infectious disease.

The estimated number of occupational HBV infections among U.S. healthcare workers has decreased significantly over the last 20 years. Data from surveillance systems indicated a 96% decline in HBV infections among healthcare workers over a 17-year period-from nearly 11,000 cases in 1983 to fewer than 400 in 1999. This reduction is largely due to the adoption of universal precautions in the mid-1980s by healthcare facilities and the 1992 OSHA Bloodborne Pathogen Standard (29 CFR 1910.1030), which required employers to offer HBV vaccinations to exposed workers (NIOSH, 2004).

During the time frame from 1981 through December 2002, 57 cases of documented occupational transmission of HIV to healthcare workers occurred. In that same time frame, 139 cases of occupational transmission of HIV to healthcare workers were possible (NIOSH, 2004).

Most documented cases of occupational HIV transmission occurred among nurses (24 cases or 42.1%) and laboratory workers (19 cases or 33.3%). These cases were reported to the HIV/AIDS Reporting System. Among the documented cases of HIV following occupational exposure, 84% resulted from percutaneous exposure (NIOSH, 2004).

Healthcare workers must be educated concerning the risk of and prevention for bloodborne pathogens, including the need to be vaccinated against HBV. Employers are required to establish exposure control plans that include post-exposure followup for employees and to comply with the incident reporting requirements of the 1992 OSHA Bloodborne Pathogens Standard.

Exposure prevention remains the primary strategy for reducing occupational bloodborne pathogen infections. However, occupational exposures will continue to occur, and post exposure prophylaxis (PEP) is an important element of exposure management (CDC, 2005).

Access to clinicians who can provide post-exposure care should be available during all working hours, including nights and weekends. Hepatitis B immunoglobulin (HBIG), HBV vaccine and antiretroviral agents for post-exposure prophylaxis (PEP) should be available in a timely manner, either by providing access onsite or by developing linkages with providers or facilities that can provide such service off-site. Those individuals who are responsible to provide post-exposure management must be knowledgeable about the evaluation and treatment protocols and the facility's plans for accessing post-exposure medications (CDC, 2005).

The recommendations provided by the CDC (See Tables 3 and 4) apply to situations in which healthcare providers have been exposed to a source person who either has or is considered likely to have HIV infection. These recommendations are based on the risk for HIV infection after different types of exposure and on limited data regarding efficacy and toxicity of PEP. If PEP is offered and taken and the source is later determined to be HIV-negative, PEP should be discontinued (CDC, 2005).

Although concerns have been expressed regarding HIV-negative sources being in the window period for seroconversion, no case of transmission involving an exposure source during the window period has been reported in the United States. Rapid HIV testing of source patients can facilitate making timely decisions regarding use of HIV PEP after occupational exposures to sources of unknown HIV status. Because the majority of occupational HIV exposures do not result in transmission of HIV, potential toxicity must be considered when prescribing PEP. Because of the complexity of selecting HIV PEP regimens, when possible, these recommendations should be implemented in consultation with persons having expertise in antiretroviral therapy and HIV transmission. Reevaluation of exposed healthcare providers should be strongly encouraged within 72 hours postexposure, especially as additional information about the exposure or source person becomes available (CDC, 2005)

Healthcare workers must be informed to report occupational exposures immediately after they occur because prophylactic treatment is most effective when administered as soon after the exposure as possible. PEP is preferably within hours rather than days of exposure (CDC, 2005).

Healthcare facilities will have policies and procedures for the prevention of occupational exposure in place as part of their administrative controls related to infection control, however, these facilities will also have policies and procedures in place regarding reporting, evaluation, counseling, treatment and follow-up of occupational exposure (CDC, 2005).

In the event that wounds or skin sites have been in contact with blood or body fluids, the sites must immediately be washed with soap and water; mucous membranes should be flushed with water. No evidence exists that using antiseptics for wound care or expressing fluid by squeezing the wound further reduces the risk of transmission; however, the use of antiseptics is not contraindicated (CDC, 2005).

In the event of an occupational exposure, the exposure and post-exposure management should be recorded in the exposed person's medical record. A facility may have a specific form for such an exposure. Employers must follow all federal and state requirements for recording and reporting occupational injuries and exposures (CDC, 2005).

The CDC (2005) recommends that the following information be recorded in the exposed person's confidential medical record:

- Date and time of exposure;
- Details of the procedure being performed, including where and how the exposure occurred; if related to a sharp device, the type and brand of device, and how and when in the course of handling the device the exposure occurred;
- Details of the exposure, including type and amount of fluid or material and the severity of the exposure (e.g., for a percutaneous exposure, depth of injury and whether fluid was injected; for a skin or mucous membrane exposure, the estimated volume of material) and the condition of the skin (e.g., chapped abraded, intact).
- Details about the exposure source (e.g., whether the source material contained HBV, HCV or HIV; if the source is HIV-infected, the stage of disease, history of antiretroviral therapy, viral load, antiretroviral resistance information, if known).
- Details about the exposed person (e.g., HBV vaccination and vaccine response status).
- Details about counseling, post-exposure management and follow-up.

Basic and Expanded HIV Postexposure Prophylaxis Regimens can be found in the Appendix of *Updated US Public Health Service Guidelines for the Management of Occupational Exposures to HIV and Recommendations for Post Exposure Prophylaxis* (2005) available at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5409a1.htm

Table 3

TABLE 1. Recommended HIV postexposure prophylaxis (PEP) for percutaneous injuries

	Infection status of source				
Exposure type	**HIV-positive, class 1***	**HIV-positive, class 2***	**Source of unknown HIV status†**	**Unknown source§**	**HIV-negative**
Less severe¶	Recommend basic 2-drug PEP	Recommend expanded ≥3-drug PEP	Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors††	Generally, no PEP warranted; however, consider basic 2-drug PEP** in settings in which exposure to HIV-infected persons is likely	No PEP warranted
More severe§§	Recommend expanded 3-drug PEP	Recommend expanded ≥3-drug PEP	Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors††	Generally, no PEP warranted; however, consider basic 2-drug PEP** in settings in which exposure to HIV-infected persons is likely	No PEP warranted

* HIV-positive, class 1 — asymptomatic HIV infection or known low viral load (e.g., <1,500 ribonucleic acid copies/mL). HIV-positive, class 2 — symptomatic HIV infection, acquired immunodeficiency syndrome, acute seroconversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of PEP should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.

† For example, deceased source person with no samples available for HIV testing.

§ For example, a needle from a sharps disposal container.

¶ For example, solid needle or superficial injury.

** The recommendation "consider PEP" indicates that PEP is optional; a decision to initiate PEP should be based on a discussion between the exposed person and the treating clinician regarding the risks versus benefits of PEP.

†† If PEP is offered and administered and the source is later determined to be HIV-negative, PEP should be discontinued.

§§ For example, large-bore hollow needle, deep puncture, visible blood on device, or needle used in patient's artery or vein.

Table 4

TABLE 2. Recommended HIV postexposure prophylaxis (PEP) for mucous membrane exposures and nonintact skin* exposures

	Infection status of source				
Exposure type	**HIV-positive, class 1†**	**HIV-positive, class 2†**	**Source of unknown HIV status§**	**Unknown source¶**	**HIV-negative**
Small volume**	Consider basic 2-drug PEP††	Recommend basic 2-drug PEP	Generally, no PEP warranted§§	Generally, no PEP warranted	No PEP warranted
Large volume¶¶	Recommend basic 2-drug PEP	Recommend expanded ≥3-drug PEP	Generally, no PEP warranted; however, consider basic 2-drug PEP†† for source with HIV risk factors§§	Generally, no PEP warranted; however, consider basic 2-drug PEP†† in settings in which exposure to HIV-infected persons is likely	No PEP warranted

* For skin exposures, follow-up is indicated only if evidence exists of compromised skin integrity (e.g., dermatitis, abrasion, or open wound).

† HIV-positive, class 1 — asymptomatic HIV infection or known low viral load (e.g., <1,500 ribonucleic acid copies/mL). HIV-positive, class 2 — symptomatic HIV infection, AIDS, acute seroconversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of PEP should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.

§ For example, deceased source person with no samples available for HIV testing.

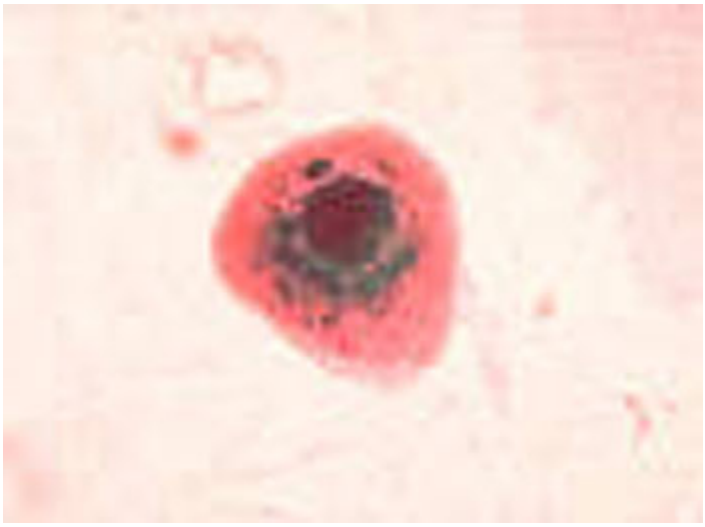
¶ For example, splash from inappropriately disposed blood.

** For example, a few drops.

†† The recommendation "consider PEP" indicates that PEP is optional; a decision to initiate PEP should be based on a discussion between the exposed person and the treating clinician regarding the risks versus benefits of PEP.

§§ If PEP is offered and administered and the source is later determined to be HIV-negative, PEP should be discontinued.

¶¶ For example, a major blood splash.



Cytomegalovirus infection of cell in urine. Photo #1157, courtesy of CDC/ Dr. Haraszti.

Conclusion

Because of the potential for significant harm to patients, healthcare providers, staff and visitors, infection control continues to be a critical aspect of healthcare, one that has far-reaching implications. Because of emerging infectious diseases, multi-drug resistant organisms, as well as advances in technology and research, frequent review and update on the topic of infection control is needed. New York State is committed to healthcare providers who reinforce and update their own professional knowledge and skills on this topic. Keeping current about this ever-changing content helps professionals to safeguard the health of the population of this state, particularly because HAIs continue at an alarmingly high rate with significant morbidity and mortality.

In New York State it is a legal requirement that healthcare professionals' practice must adhere to current scientifically accepted infection control practices. Lapses in one's own practice, or the practice of those for whom the professional has administrative or supervisory oversight responsibility, leaves the professional open to charges of unprofessional conduct with the New York State Education Department and/or the New York State Department of Health.

It has been repeatedly shown through surveillance and research that the simple intervention of handwashing/handhygiene is a critical factor is breaking the chain of infection. Good hand hygiene is one intervention that healthcare providers cannot afford to neglect; the health of the people of New York State is in your hands!

Resources

Centers for Disease Control and Prevention
www.cdc.gov

National Institute for Occupational Safety and Health
www.cdc.gov/niosh/

New York State Department of Health
http://www.health.state.ny.us/

Occupational Safety and Health Administration
www.osha.gov

Regional Epidemiology Program
Bureau of Communicable Disease Control
New York State Department of Health
ESP, 651 Corning Tower

Albany, New York 12237-0627
Telephone: (518) 473-4439
Fax: (518) 474-7381
www.health.state.ny.us

National Healthcare Safety Network (NHSN)
http://www.cdc.gov/nhsn/

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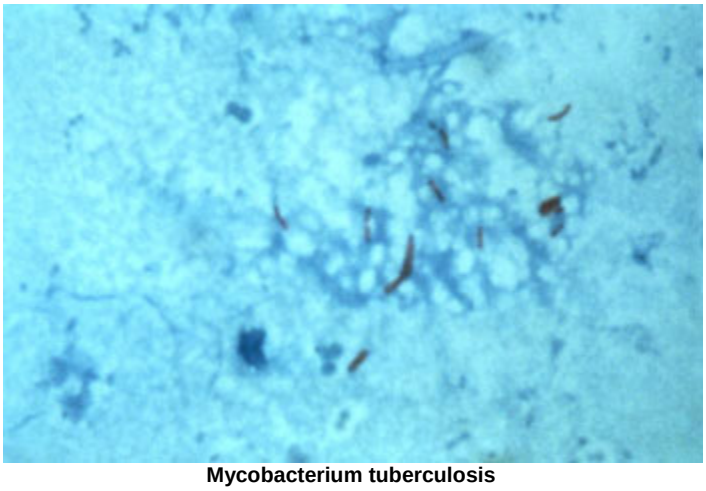

Mycobacterium tuberculosis

Course Test

1. Ms. A, a registered nurse, has supervisory responsibility for a licensed practical nurse, Mr. B. Ms. A observed Mr. B change a dressing on a patient and then go to another patient's room without changing gloves, or washing his hands. Ms. A has noticed that this has occurred at other times as well. She made a mental note of it and planned to speak to Mr. B about this. Unfortunately, Ms. A was distracted by other priorities on the unit and neglected to follow up with Mr. B. What could be the outcome of this situation?

    A. Mr. B could be charged with unprofessional conduct for failing to adhere to scientifically accepted principles and practices of infection control.
    B. Ms. A could be charged with unprofessional conduct for failing to insure that Mr. B, for whom Ms. A has administrative and clinical oversight, adheres to scientifically accepted principles and practices of infection control.
    C. Both A and B.
    D. None of the above.

2. According to the CDC, there are approximately 2 million healthcare acquired infections (HAIs) annually. Of these infections almost 99,000 people die annually.

    A. True.
    B. False.

3. Infections can be prevented by interrupting one or more of the "links" in the Chain of Infection. This can be achieved through:

    A. Utilizing personal protective equipment (PPE) and Standard Precautions while providing care and treatment to patients in an acute care hospital.
    B. Insuring that healthcare staff, who serve patients in a home care agency, are in good health and are current with recommended adult immunizations.
    C. Cleaning and disinfecting equipment for a free-standing surgery center while adhering to manufacturers' and CDC guidelines.
    D. All of the above.

4. According to the National Institute for Occupational Safety and Health (NIOSH), the most common route of exposure of US hospital healthcare workers to blood or other body fluids is through:

    A. Contact with mucous membranes of the eyes, nose or mouth.
    B. Percutaneous injuries with contaminated sharp instruments such as needles and scalpels.
    C. Human bites.
    D. Exposure though broken or abraded skin.

5. According to the CDC (2002), healthcare personnel only practice hand hygiene about half the time. In the CDC's Guidelines for Isolation Precautions: Preventing Transmission of Infectious Agents in the Healthcare Setting (2007), a summary of recent research on healthcare personnel and hand hygiene reported:

    A. The self-reports of healthcare providers indicated higher adherence than those reported in observational studies.
    B. Among nurses and physicians, the number of years of experience was a negative predictor of adherence.
    C. Education was used as the primary intervention to improve adherence in most studies. While positive changes in knowledge and attitude were demonstrated, accompanying behavioral changes were limited or did not occur.
    D. All of the above.

6. The CDC's Hand Hygiene Guidelines (2002) covered in this course recommend that if hands are not visibly soiled, use an alcohol-based hand rub for routinely decontaminating hands in clinical situations. Alternatively, wash hands with an antimicrobial soap and water in clinical situations.

    A. True.
    B. False.

7. A hierarchy of controls are used to minimize the risk of infection in healthcare facilities.

    These controls include:

    - Legal and regulatory controls.
    - Administrative and training controls.
    - Engineering controls.
    - Work practice controls.

    A. True.
    B. False.

8. Standard precautions are based on the concept that blood and body fluids must be treated as if infectious, therefore personal protective equipment (PPE) is needed as a barrier to transmission of infectious agents. The choice of PPE is determined by the type of interaction the healthcare worker has with the patient.

    A. True.
    B. False.

9. Personal Protective Equipment (PPE) for standard precautions include all the following **EXCEPT**:

    A. Gloves when touching body blood, body fluids, secretions, excretions, contaminated items, for touching mucous membranes and non-intact skin.
    B. Gowns during procedures and patient care activities when contact of clothing/exposed skin with blood/body fluids, secretions, or excretions is anticipated.
    C. Gloves, gowns and masks for all routine care.
    D. Masks and goggles or a face shield during patient care activities likely to generate splashes or sprays of blood, body fluids, secretions and excretions.

10. The procedure for removing gloves is:

    - Grab outside edge near wrist;
    - Peel away from hand, turning glove inside out;
    - Hold in opposite gloved hand;
    - Slide ungloved finger under the wrist of the remaining glove;
    - Peel off from inside, creating a bag for both gloves;
    - Discard.

    A. True.
    B. False.

11. The level of contamination on healthcare equipment and environmental surfaces is dependent upon:

    A. Types of microorganisms.
    B. Number of microorganisms.
    C. Potential for cross-contamination.
    D. All of the above.

12. Healthcare workers do not need to immediately attend to an occupational exposure to blood or body fluids, since prophylactic treatment is most effective if administered as soon as possible after antibodies form.

    A. True
    B. False

13. Since the 1992 Bloodborne Pathogens Standard in which hepatitis B vaccination has been required to be provided to healthcare workers, as well as Standard Precautions, the incidence of occupational transmission of the hepatitis B virus has decreased by 96%.

    A. True
    B. False

14. After percutaneous injury with a contaminated sharp instrument, the average risk of HIV infection is:

    A. 0.8%
    B. 30%
    C. 0.3%
    D. 6%

15. For professionals who practice in settings where handling, cleaning, and reprocessing equipment, instruments or medical devices is performed in a dedicated Sterile Processing Department, it is important to understand core concepts and principles of infection control, including:

    - Standard and Universal Precautions including PPE;
    - Cleaning, disinfection, and sterilization;
    - Appropriate application of safe practices for handling instruments, medical devices and equipment;
    - Designation and physical separation of patient care areas from cleaning and reprocessing areas;
    - Verify with those responsible for reprocessing what steps are necessary prior to submission regarding pre-cleaning, soaking, etc.

    A. True.
    B. False.

16. Cleaning involves the removal or destruction of all microorganisms and their spores.

    A. True
    B. False

17. The CDC Guidelines utilize the Spaulding classification, which divides instruments and items for patient care into critical, semicritical or non-critical items. Depending on the category, planning for disinfection or sterilization can be determined for the most part. Which of the following are correct?

    A. Critical items are either sterile tissue or the vascular system must be sterile. Critical items have a high risk for infection if they are contaminated with any microorganism.
    B. Non-critical items are those that come in contact with intact skin but not mucous membranes.
    C. Semicritical items contact mucous membranes or nonintact skin.
    D. All of the above.

18. All the following are related to proper sharps disposal strategies **EXCEPT**:

    A. Use a sharps container capable of maintaining its impermeability after waste treatment to avoid subsequent physical injuries during final disposal.
    B. Place disposable syringes with needles, including sterile sharps that are being discarded, scalpel blades, and other sharp items into puncture-resistant containers located as close as practical to the point of use.
    C. Do not bend, recap, or break used syringe needles before discarding them into a container.
    D. Make thorough use of a sharps container by over filling the container, even if the contents are not well contained; just be careful.

19. Which of the following is true about Safe Injection?

    A. It 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.
    B. It 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.
    C. Both A and B.
    D. Neither A or B.

20. Recent headlines in New York State and in other states have identified incidents of unsafe injection practices in some healthcare facilities which resulted in outbreaks of bloodborne pathogens. According to the CDC, the two (2) main breaches of infection control practices were:

    - Reinsertion of used needles into a multip-dose vial or solution container such as a saline bag.
    - Use of a sterile, single-use, disposable needle and syringe for each injection given.
    - Use of a single needle or syringe to administer intravenous medication to multiple patients.
    - Failure to use a 1:100 dilution (500--615 ppm available chlorine) to decontaminate nonporous surfaces.

    A. All of the above.
    B. None of the above.
    C. 1 and 3.
    D. 1, 2 and 3.