New York State Mandated Infection Control and Barrier Precautions

NYSNA Continuing Education

The New York State Nurses Association has been approved by the New York State Education Department (NYSED) to provide this course for nurses, physicians, dentists, dental hygienists, optometrists, physician assistants, podiatrists, and special assistants. This program is designed as a distance learning self study program which will meet the New York State requirements for infection control education every four years.

Upon successful completion of this course, results are forwarded electronically to the NYSED Licensing Division **everyday at 4 pm**. There is no need for you to send in the certificate - the information will be submitted to the NYSED Licensing Division for you. This saves valuable time and provides a secure and efficient record of course completion. **Please understand the NYSED requires a minimum of 3 business days to update your state record.** In addition, you will have access to an online certificate of completion that you can print for your own records **immediately** upon successful completion of the course.

*Note: Physicians and Physician Assistants will be required to have a copy of their certificate of successful completion to present to their employer or to the Department of Health.

The New York State Nurses Association is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

All American Nurses Credentialing Center (ANCC) accredited organizations' contact hours are recognized by all other ANCC accredited organizations. Most states with mandatory continuing education requirements recognize the ANCC accreditation/approval system. Questions about the acceptance of ANCC contact hours to meet mandatory regulations should be directed to the professional licensing board within that state.

NYSNA has been granted provider status by the Florida State Board of Nursing as a provider of continuing education in nursing (Provider number 50-1437).

How to Take This Course

Please take a look at the steps below; these will help you to progress through the course material, complete the course examination and receive your certificate of completion.

1. **REVIEW THE OBJECTIVES**

   The objectives provide an overview of the entire course and identify what information will be focused on. Objectives are stated in terms of what you, the learner, will know or be able to do upon successful completion of the course. They let you know what you should expect to learn by taking a particular course and can help focus your study.

2. **STUDY EACH SECTION IN ORDER**

   Keep your learning "programmed" by reviewing the materials in order. This will help you understand following sections.

3. **COMPLETE THE COURSE EXAM**

   After studying the course, click on "Course Exam" to take the test. Answer each question by clicking on the button corresponding to the correct answer. All questions must be answered before the test can be graded; there is only one correct answer per question. There is no time limit on this test. You may refer back to the course at any time by minimizing the course exam window.

4. **GRADE THE TEST**

   Next, click on "Submit Test." You will know immediately whether you passed or failed. If you do not successfully complete the exam on the first attempt, you may take the exam again. If you do not pass the exam on your second attempt, you will need to purchase the course again.

5. **FILL OUT THE EVALUATION FORM**

   Upon passing the course exam, you will be prompted to complete a course evaluation. You will have access to the certificate of completion after you complete the evaluation. At this point, you should print the certificate and keep it for your records.

Introduction

Regulated healthcare settings in New York State, such as hospitals, nursing homes and diagnostic and treatment centers have, for many years, been required to have in place infection control programs designed to protect patients, employees, and visitors. These facilities have established policies and procedures to address a number of concerns including hand hygiene, prevention of infection associated with surgery, intravenous therapy (IV), use of urinary catheters and other invasive procedures, housekeeping, disinfection and sterilization of equipment, waste disposal, and other areas that may be a source of infection. Isolation and employee health policies also limit the potential for exposure to communicable diseases and provide a mechanism for follow-up when inadvertent exposures occur. Through surveillance of infection in these settings, and quality assurance and risk management programs, compliance with infection control standards are monitored and problems identified early. Attention to the infection control program has had an important impact on reducing nosocomial and occupationally acquired infections.

However, it was the human immunodeficiency virus (HIV) and hepatitis B virus (HBV) and concern over how to protect patients from contracting these diseases through receipt of healthcare that helped to influence the training requirement you are meeting by taking this course.

The state of New York safeguards the health of the public. **The strategy that offers the greatest opportunity for protecting the public in settings where they receive healthcare, is one of assuring that infection control measures are routinely in place and routinely observed.** Such practices must provide protection from cross contamination from patient to patient, as well as patient and healthcare worker exposure to pathogens through the direct provision of care. While bloodborne pathogens were the chief concern driving policy and legislation, other pathogens transmitted by contact (e.g., staphylococci, gram negative organisms) also pose a risk. Attention to the principles of infection control will diminish the opportunity for these exposures as well.

Since 1992, the State of New York has had a requirement that certain healthcare professionals licensed in New York State receive training on infection control and barrier precautions. This requirement stipulates that the initial training include the six core elements (identified below) developed by the New York State Education Department. Chapter 786 of the Laws of 1992 affects every dental hygienist, dentist, licensed practical nurse, optometrist, physician, physician assistant, podiatrist, registered professional nurse and specialist assistant practicing in New York State.

Being fully aware of the professional and legal responsibility of the control of infection in New York State helps to protect one's license. In March, 1992, the New York State Board of Regents amended the Regents Rules, expanding the definition of unprofessional conduct to include failure to follow appropriate infection prevention techniques in healthcare practice. The New York State Department of Health has also adopted similar regulations. This training, required by Chapter 786 of the Laws of 1992, establishes that failure to adhere to such standards can be considered evidence of professional misconduct and could lead to disciplinary action.

Since this 1992 requirement was enacted in New York State, much has changed. The terrorist attacks of September 11, 2001 prompted the nation and healthcare providers have focused on the potential for weaponized biological agents. Since the events of September 11th and the subsequent bioterrorist use of *Bacillus anthracis*, we have learned more about the infection control challenges posed by those agents. Infection control specifically related to bioterrorism is beyond the scope of this course. For information regarding the control of infection related to the use of biological weapons, see the NYSNA online courses: *Biological Agents and Terrorism: A Worldwide Threat* and *Smallpox as a Biological Agent of Terror: Pre-event Information.*

The goal of this state-mandated infection control training requirement has two components.

- The first component is to assure that licensed, registered or certified health professionals understand how bloodborne pathogens may be transmitted in the work environment.

- The second component of the goal of this training is for professionals to recognize their professional responsibility for assuring that they, and those for whom they are responsible, apply scientifically accepted infection control principles, as appropriate to their work setting, to minimize the opportunity for transmission to patients and employees.

This course meets the 1992 educational requirement that identified the minimum core elements to be included in the required coursework in infection control. The minimum core elements consist of six statements, each of which defines a general content area to be addressed to meet the training requirement. In October, 2001, The New York State Education Department revised the Infection Control Training Syllabus. This online course meets the requirements of the original training requirements, as well as the revised requirements.

The Core Elements of Required Coursework in Infection Control, determined by the New York State Education Department are:

I. The 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.

II. Modes and mechanisms of transmission of pathogenic organisms in the healthcare setting and strategies for prevention and control.

III. Use of engineering and work practice controls to reduce the opportunity for patient and healthcare worker contact with potentially infectious material for bloodborne pathogens.

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

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

VI. Prevention and management of infectious or communicable diseases in healthcare workers.

The law requires that professionals' initial coursework in this mandatory infection control training include the six elements listed above, and that infection control training must occur every 4 years thereafter. Once the initial mandatory course requirement has been met, in subsequent 4-year periods, professionals may repeat the infection control coursework that includes the six elements above, or they may take infection control training that relates more specifically to their clinical practice. As a healthcare professional in New York State, you are required to attest to having completed this requirement to the State Education Department at every subsequent registration period.

Objectives

At the completion of this learning activity the learner will be able to:

- Explain the benefit to patients and healthcare workers of adhering to scientifically accepted principles and practices of infection control.
- Describe/explain the professional's responsibility to adhere to and monitor scientifically accepted infection control practices and the consequences of failing to comply.
- Describe/explain the professional's responsibility to monitor infection control practices of those for whom she/he is responsible and intervene as necessary for compliance and safety.
- Describe how pathogenic organisms may be spread in healthcare settings.
- Identify factors that influence the outcome of an exposure and list strategies for preventing transmission of pathogenic organisms.
- Describe how infection control concepts are applied in professional practice.
- Define "engineering controls" and "work practice controls" and identify where these controls can be used to prevent exposure.
- Identify a hierarchy of exposure prevention strategies.
- Describe specific practices and settings that increase the opportunity for exposure to healthcare workers and patients.
- Describe circumstances requiring 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 of potentially infectious material.
- Discuss the importance of the correct application of reprocessing methods for assuring the safety and integrity of patient care equipment.
- Identify the individual's professional responsibility for maintaining a safe patient care environment.
- Identify strategies for effective pre-cleaning, chemical disinfection, and sterilization of instruments and devices.
- Discuss the role of occupational health strategies in protecting healthcare workers and patients.
- Explain nonspecific disease findings that should prompt evaluation of healthcare workers.
- Identify occupational health strategies for preventing bloodborne diseases and other communicable diseases in healthcare workers.
- Identify resources for evaluation of healthcare workers infected with HIV, HBV and /or HCV.

Element I: Responsibility to Adhere to Scientifically Accepted Principles and Practices

The first element of the New York State mandatory infection control training addresses the 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. This responsibility is a legal, professional and ethical requirement. Federal regulations, New York State regulations, and a variety of Standards of Professional Practice all impact of the responsibility of the professional to utilize current infection control standards.

Federal Regulations and Agencies

The **Occupational Safety and Health Administration** (OSHA) was established by Congress in 1970. It is part of the US Department of Labor and is responsible for creating and enforcing workplace safety and health regulations. It mandates that employers provide a safe and healthy environment for their employees. Effective March 6, 1992, OSHA issued the Bloodborne Pathogen Standard (29 CFR 1910.1030; 56 Fed. Reg. 4004) that helped to reduce healthcare worker exposure to blood or other potentially infectious materials and prevent occupational transmission of multiple pathogens. Notable elements of this standard require:

- A written exposure control plan designed to eliminate or minimize worker exposure to bloodborne pathogens
- Compliance with universal precautions (an infection control principle that treats all human blood and other potentially infectious materials as infectious)
- Engineering controls and work practices to eliminate or minimize worker exposure
- Personal protective equipment (if engineering controls and work practices do not eliminate occupational exposures)
- Prohibition of bending, recapping, or removing contaminated needles and other sharps unless such an act is required by a specific procedure or has no feasible alternative
- Prohibition of shearing or breaking contaminated needles (OSHA defines contaminated as the presence or the reasonably anticipated presence of blood or other potentially infectious materials on an item or surface)
- Free hepatitis B vaccinations offered to workers with occupational exposure to bloodborne pathogens
- Worker training in appropriate engineering controls and work practices
- Post-exposure evaluation and follow-up, including post-exposure prophylaxis when appropriate

In the absence of a specific standard, OSHA evokes the “General Duty Clause”, which assesses the compliance of employers in providing employees with a safe working environment. This “General Duty Clause” can be used to enforce guidelines when no specific standard exists. In October, 1993, OSHA issued guidelines to protect workers against Tuberculosis. Enforcement of these guidelines rests on the General Duty Clause.

In November 1999, OSHA issued a Compliance Directive to the Bloodborne Pathogen Standard. This action provided instructions to cite employers for failing to evaluate, purchase and implement safer needles and other safer sharps devices.

On November 6, 2000, The Needlestick Safety and Prevention Act (P.L. 106-430) became law. The Needlestick Safety and Prevention Act amended the existing Bloodborne Pathogen Standard

administered by OSHA to require the use of safer devices to protect healthcare workers from sharps injuries. It also required that employers solicit the input of employees responsible for direct patient care, who are potentially exposed to sharps injuries, in the identification, evaluation and selection of effective engineering and work-practice controls. The bill also required employers to maintain a sharps injury log to contain, at a minimum, the type and brand of device involved in the incident; the department or work area where the exposure incident occurred; and an explanation of how the incident occurred. The information is to be recorded and maintained in a way that would protect the confidentiality of the injured employees. The log is an important source of data for researchers to determine the relative effectiveness and safety of devices now on the market and those that may be developed in the future.

OSHA has been serious about enforcement of this law. Since the 2000 Needlestick Safety and Prevention Act was passed, OSHA has issued citations to healthcare facilities that have not been in compliance. In 2003, OSHA issued 2 citations that were ground breaking because of the size of the penalty and because of the detail and scope of the violation (Perry and Jagger, 2003). Beaver Valley Nursing Home and Rehabilitation Center in Beaver Valley, Pennsylvania was fined over $90,000 for violations related to deficiencies in their exposure control plan and related to safety device evaluation (that is, not having front-line workers involved in the selection and evaluation of safety devices), post-exposure counseling and handling of sharps containers. The largest part of the violation and subsequent fine was for failure to use safety devices; the maximum penalty, $70,000 was issued. The nursing home had been surveyed 3 years earlier and multiple safety violations which had been identified in the earlier report had not been addressed (Perry and Jagger, 2003).

Also in 2003, Montefiore Medical Center in New York City was investigated, in response to complaints by medical residents, for failure to use safety-engineering devices; improper handling of contaminated reusable sharps and failure to make available or use personal protective equipment. There were also recordkeeping and documentation deficiencies (Perry and Jagger, 2003).

The Food and Drug Administration (FDA) is also involved in infection control through their efforts to reduce needlestick injuries. Under the FDA application clearance process (FDA, 1995), the manufacturers of medical devices (including needles used in patient care) must meet requirements for appropriate registration and for listing, labeling, and good manufacturing practices for design and production. The process for receiving clearance or approval to market a device requires device manufacturers to:

1. Demonstrate that a new device is substantially equivalent to a legally marketed device or
2. Document the safety and effectiveness of the new device for patient care through a more involved premarket approval process

The FDA has also released two advisories pertaining to sharps and the risk of bloodborne pathogen transmission in the health care setting (FDA, 1992; FDA, et al., 1999).

The **Centers for Disease Control and Prevention** (CDC), a part of the United States Department of Health and Human Services, is recognized as the lead federal agency for protecting the health and safety of the population, providing credible information to enhance health decisions, and promoting health through strong partnerships. CDC serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities designed to improve the health of the people of the US (CDC, 2004); the CDC includes 12 Centers, Institute, and Offices.

It was the CDC that defined and disseminated the concept of *Universal Precautions* in 1987 as a set of precautions designed to prevent transmission of human immunodeficiency virus (HIV), hepatitis B virus (HBV), and other bloodborne pathogens when providing first aid or healthcare. Under universal

precautions, blood and certain body fluids of all patients are considered potentially infectious for HIV, HBV and other bloodborne pathogens.

Universal precautions took the place of and eliminated the need for the *Body Substance Isolation* (BSI) category "Blood and Body Fluid Precautions" in the 1983 CDC Guidelines for Isolation Precautions in Hospitals. However, implementing universal precautions does not eliminate the need for other isolation precautions, such as droplet precautions for influenza, airborne isolation for pulmonary tuberculosis, or contact isolation for methicillin-resistant *Staphylococcus aureus*.

In 1996, the CDC published new guidelines, *Standard Precautions***,** for isolation precautions in hospitals. Standard precautions synthesize the major features of BSI and universal precautions to prevent transmission of a variety of organisms. Standard precautions were developed for use in hospitals and may not necessarily be indicated in other settings where universal precautions are used, such as childcare settings and schools.

Another federal agency that is concerned with worker safety is the **National Institute for Occupational Safety and Health** (NIOSH). NIOSH was created in 1970 by the same act of Congress that created OSHA. It is part of the Centers for Disease Control and Prevention (CDC) and is responsible for research and making specific recommendations and disseminating information on the prevention of workplace disease, injury and disability.

New York State Regulations

In addition to federal laws and regulations, New York State also has requirements related to infection control. All licensed healthcare facilities are responsible under existing regulations for monitoring and enforcing proper use of infection control practices and universal precautions by healthcare personnel functioning under their jurisdiction. Failure to comply with this requirement will result in Department of Health citation, potential fines and other disciplinary action against the institution.

As stated previously, in 1992 New York State established provisions to protect the public from exposure to HIV, HBV and other pathogens during medical and dental procedures. The requirement for this training was also established.

Proof of completion of required infection control training must be submitted by health professionals to either the New York State Education Department or the New York State Department of Health. Physicians with hospital privileges will present the necessary training documentation to the hospital (in lieu of the Department of Health) during the process of renewing hospital privileges. A waiver of this training requirement may be granted by the Department of Health to health professionals who demonstrate that such training is not needed due to the nature of their work, or that they have met criteria for equivalency.

Vital to complete understanding of the professional standards related to infection control practices, is **The New York State Education Department, Rules of the Board of Regents**, Part 29.2 (a)(13), Unprofessional Conduct in the Area of Infection Control, issued in 1992. These rules addressed professional responsibility related to infection control. General provisions for health professionals relate to the following professionals:

> Medicine, acupuncture, physical therapy, physician's assistant, specialist's assistant, chiropractic, dentistry, dental hygiene, pharmacy, podiatry, optometry, ophthalmic dispensing, psychology, social work, massage, occupational therapy, speech pathology, audiology, nursing (registered professional nurse, licensed practical nurse):

The general provisions for health professionals states that unprofessional conduct shall include:

“Failing to use scientifically accepted infection prevention techniques appropriate to each profession for the cleaning and sterilization or disinfection of instruments, devices, materials and work surfaces, utilization of protective garb, use of covers for contamination-prone equipment and the handling of sharp instruments. Such techniques shall include but not be limited to:

1. wearing of appropriate protective gloves at all times when touching blood, saliva, other body fluids or secretions, mucous membranes, nonintact skin, blood-soiled items or bodily fluid-soiled items, contaminated surfaces, and sterile body areas, and during instrument cleaning and decontamination procedures;

2. discarding gloves used following treatment of a patient and changing to new gloves if torn or damaged during treatment of a patient; washing hands and donning new gloves prior to performing services for another patient; and washing hands and other skin surfaces immediately if contaminated with blood or other body fluids;

3. wearing of appropriate masks, gowns or aprons, and protective eyewear or chin-length plastic face shields whenever splashing or spattering of blood or other body fluids is likely to occur;

4. sterilizing equipment and devices that enter the patient's vascular system or other normally sterile areas of the body;

5. sterilizing equipment and devices that touch intact mucous membranes but do not penetrate the patient's body or using high-level disinfection for equipment and devices which cannot be sterilized prior to use for a patient;

6. using appropriate agents, including but not limited to detergents for cleaning all equipment and devices prior a sterilization or disinfection;

7. cleaning, by the use of appropriate agents, including but not limited to detergents, equipment and devices which do not touch the patient or that only touch the intact skin of the patient;

8. maintaining equipment and devices used for sterilization according to the manufacturer's instructions;

9. adequately monitoring the performance of all personnel, licensed or unlicensed, for whom the licensee is responsible regarding infection control techniques;

10. placing disposable used syringes, needles, scalpel blades, and other sharp instruments in appropriate puncture-resistant containers for disposal; and placing reusable needles, scalpel blades, and other sharp instruments in appropriate puncture-resistant containers until appropriately cleaned and sterilized;

11. maintaining appropriate ventilation devices to minimize the need for emergency mouth-to-mouth resuscitation;

12. refraining from all direct patient care and handling of patient care equipment when the healthcare professional has exudative lesions or weeping dermatitis and the condition has not been medically evaluated

and determined to be safe or capable of being safely protected against in providing direct patient care or in handling patient care equipment; and

13. placing all specimens of blood and body fluids in well-constructed containers with secure lids to prevent leaking; and cleaning any spill of blood or other body fluid with an appropriate detergent and appropriate chemical germicide."

Any licensed healthcare professional who fails to use appropriate infection control techniques to protect patients or fails to ensure that healthcare workers under his/her supervision do so may be subject to charges of professional misconduct.

Any patient or employee complaint regarding lax infection control practices in a private medical or dental office will prompt an investigation by the Departments of Health and/or Education. Substantiated lapses in infection control in a private practice setting may result in charges of professional misconduct against any licensed professional in the practice who was directly involved, was aware of the violation or who has responsibility for ensuring that office staff is adequately trained and follow patient protection measures.

Effective in 1993, Part 92, **Infection Control Requirements, of Title 10 (Health) of the Official Compilation of the Codes, Rules and Regulations of New York** addresses unprofessional conduct related to infection control issues for physicians, physicians' assistants and specialist assistants.

"For physicians, registered physician assistants, and specialist assistants, the definition of unprofessional conduct shall include the failure to use scientifically accepted infection control practices to prevent transmission of disease pathogens from patient to patient, physician to patient, registered physician assistant or specialist assistant to patient, employee to patient, and patient to employee, as appropriate to physicians, registered physician assistants and specialist assistants. Such practices include:

(a) Adherence to scientifically accepted standards for: hand washing; aseptic technique; use of gloves and other barriers for preventing bi-directional contact with blood and body fluids; thorough cleaning followed by sterilization or disinfection of medical devices; disposal of non-reusable materials and equipment; and cleaning between patients of objects that are visibly contaminated or subject to touch contamination with blood or body fluids;

(b) Use of scientifically accepted injury prevention techniques or engineering controls to reduce the opportunity for patient and employee exposure; and

(c) Performance monitoring of all personnel, licensed or unlicensed, for whom the licensee is responsible regarding infection control techniques.

Implications of Professional Conduct Standards

The individual professional is responsible to adhere to infection control standards as clearly stated in law, as well as agency policies and procedures. The professional is also responsible for monitoring others and insuring that standards are carried out.

Consequences of failing to follow accepted standards of infection control include increased risk of adverse health outcomes for patients and healthcare workers. Additionally, the professional may be subject to charges of unprofessional conduct. Charges of unprofessional conduct are investigated by the Office of the Professions, New York State Education Department or the Department of Health. A charge of professional misconduct can be made even when there is no adverse effect on the patient.

Mechanisms for Reporting Unprofessional Conduct

Complaints and reports are made to the New York State Department of Health if physicians, physicians' assistants or specialist assistants are involved. All other complaints are reported to the specific professional licensing board at the New York State Education Department. Individuals and organizations are required to report and failure to do so may result in charges against the individual failing to report.

The complaint will be investigated. After investigation, if the charge of professional misconduct is substantiated, the professional may be subject to disciplinary action, revocation of the professional license and/or legal action for liability.

Additional New York State Regulations and Agencies

New York State Public Employees Safety and Health Act (PESH) oversees workplace protection of public employees.

New York Standards for Hospitals State Health Code regulates all article 28 facilities licensed by the state. Part 405 prescribes many health standards to which hospitals must comply. e.g., infection control standards.

New York State Department of Health Guidelines relate to infection control, prevention of transmission of HIV and HBV, immunizations for prevention of communicable diseases, as well as infection control training.

Professional Organizations

Multiple professional organizations exist that address issues of infection control. The following are organizations that speak generically to infection control:

- **Association for Professionals in Infection Control and Epidemiology, Inc. (APIC)**

  The Association for Professionals in Infection Control & Epidemiology is a multi-disciplinary, voluntary, international member organization that is committed to improving healthcare and patient safety by preventing and minimizing risks of infection and other adverse outcomes. APIC provides clinical education, practice guidance, information resources and management, certification, research and public policy advocacy. APIC works to advance healthcare epidemiology through education, collaboration, research, practice and credentialing (APIC, 2004).

  APIC is a strong proponent of scientifically based programs and policy designed to protect and enhance public health and patient safety. APIC members, often working on the front lines in infection control and public health capacities, recognize the critical need for enhanced prevention measures as well as increased surveillance and benchmarking for infectious diseases and other adverse outcomes.

  The American Journal of Infection Control is APIC's official publication.

- **Society for Healthcare Epidemiology of America (SHEA)**

  The Society for Healthcare Epidemiology of America (SHEA) was organized in 1980 to foster the development and application of the science of healthcare epidemiology. Healthcare epidemiology is broadly defined as any activity designed to study and/or improves patient care outcomes in any type of healthcare institution or setting. Healthcare epidemiology, as practiced by SHEA members, includes a variety of disciplines and activities directed at enhancing the quality of health care and preventing and controlling adverse outcomes. Among these activities are

epidemiologic and laboratory investigation, surveillance, risk reduction programs focused on device and procedure management, policy development and implementation, education and information dissemination, and cost-benefit assessment of prevention and control programs (SHEA, 2004).

Infection Control and Hospital Epidemiology is SHEA's official publication.

- **Joint Commission on Accreditation of Healthcare Organizations (JCAHO)**

  The Joint Commission evaluates and accredits nearly 16,000 healthcare organizations and programs in the United States. An independent, not-for-profit organization, the Joint Commission, sets professionally based standards and evaluates the compliance of healthcare organizations against these benchmarks (JCAHO, 2004).

  This accrediting agency focuses on promoting positive health outcomes and measuring the effectiveness of educational efforts relative to infection control. To earn and maintain accreditation, a healthcare organization must undergo an on-site survey by a JCAHO survey team at least every three years; laboratories must be surveyed every two years.

- **American Hospital Association (AHA)**

  The American Hospital Association is a national organization that represents all types of hospitals, healthcare systems, networks and other providers of care. They advocate and represent their members' interests and perspectives in health policy development, legislative and regulatory debates and judicial matters. The AHA provides education for healthcare leaders and is a source of information on healthcare trends and issues.

Additional organizations have published guidelines regarding infection control; some have standards that are specific to their practices; among them are:

- The Association of Operating Room Nurses (AORN) and the Society of Gastroenterology Nurses have guidelines for the care, reprocessing and storage of patient instruments and medical devices.

- American Society of Healthcare Central Service Personnel of the American Hospital Association has published recommended practices for decontamination of medical devices, instruments and equipment.

- The Association for Advancement of Medical Instrumentation has publications concerning medical devices, instruments and equipment.

- The American Dental Association has published extensive guidelines for prevention of occupational exposure in the workplace.

The various professional disciplines, generally in their codes of ethics, include provisions about protecting the health of the patient. Some examples include:

- The American Nurses Association's (2001) *Code of Ethics for Nurses,* states "The nurse promotes, advocates for, and strives to protect the health, safety, and rights of the patient".

- The American Medical Association's (2001) *Principles of Medical Ethics*, states "A physician shall be dedicated to providing competent medical care, with compassion and respect for human dignity and rights".

- The American Dental Association's (2004*) Principles of Ethics and Code of Professional Conduct* states "The dentist has a duty to refrain from harming the patient". This principle expresses the concept that dentists have a duty to protect the patient from harm. Included in this principle is the dentist's primary obligation to keeping knowledge and skills current. These ethical principles specifically address bloodborne pathogens.

Element II: Transmission, Prevention and Control of Infection

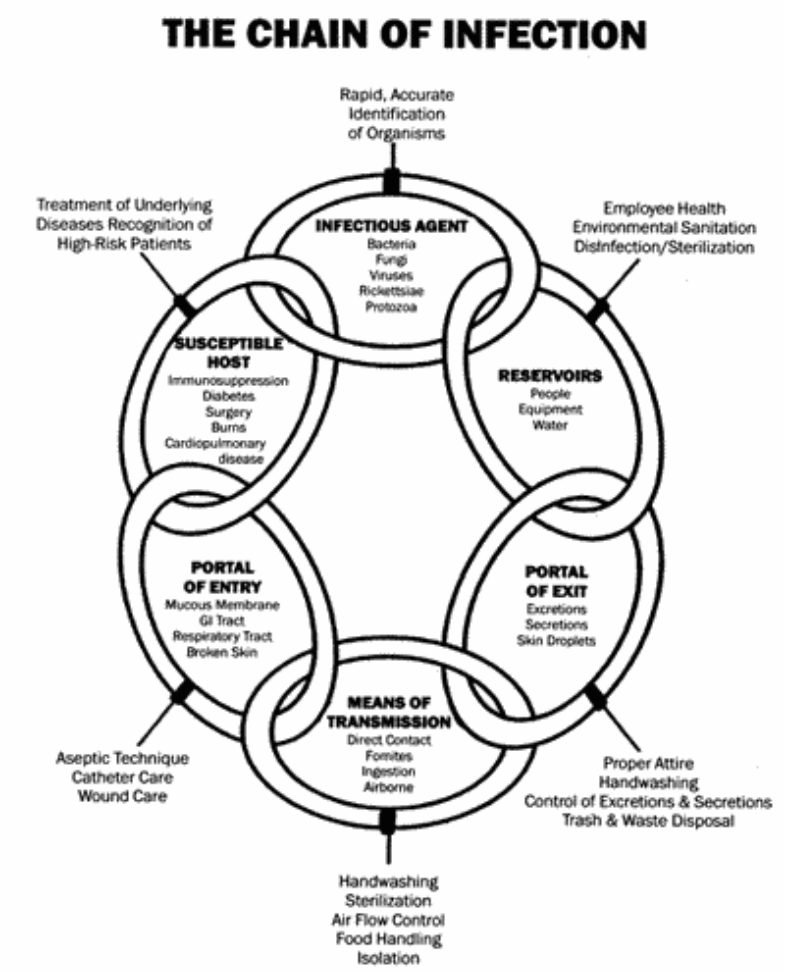
This element of the New York State mandatory infection control training discusses the modes and mechanisms of transmission of pathogenic organisms in the healthcare setting and strategies for prevention and control. Healthcare professionals will likely be well versed in this element of the required training; consider it a review.

Overview of Infection Transmission

An **infection** entails the replication of organisms in the tissues of a host, with a development of an overt clinical manifestation, commonly known as disease.

The concept of "The Chain of Infection", well known to healthcare professionals, includes six elements, or links in the chain, that are needed for an infection to occur: pathogen, reservoir, portal of exit, mode of transmission, portal of entry and susceptible host.

- **The Pathogen:** The presence of a pathogen, or infectious agent, is required for an infection to occur. Pathogens are found in the patient, healthcare workers, and the environment; there are countless microorganisms. Common pathogens include:
    - **Bacteria** - single celled microorganisms e.g., TB, MRSA, *streptococcus*, *E. Coli*, *pseudomonas, C. difficile.*
    - **Viruses**- sub microscopic, need a host to grow e.g., herpes, influenza, HIV, HBV, HBC, varicella zoster.
    - **Fungi** – molds and yeasts that live on plants and animals, e.g., candida, aspergillus, cryptococcus.
    - **Parasites** – seen less frequently in healthcare; e.g., protozoa, tapeworm or roundworm and arthropods such as lice or ticks.



Role and nature of reservoirs/source – Any person, animal, arthropod, plant, soil or substance (or combination of these) in which an infectious agent normally lives and multiplies, on which it depends primarily for survival, and where it reproduces itself in such a manner that it can be transmitted to a susceptible host. All microorganisms have a reservoir and a source. They may be the same or they may be different. Infectious agents differ in their growth and survival requirements. Knowledge of potential reservoirs enable healthcare workers to identify sources and focus on prevention and control efforts. The source is the place from which the pathogen passes to the host, through a vehicle of transmission.

Other sources of infecting microorganisms can be the patient's own endogenous flora, which may be difficult to control, and inanimate environmental objects that have become contaminated, including equipment and medications.

Reservoirs are places where the organism lives and grows. Reservoirs can be animate, such as people or animals, for example the healthcare worker, or a wound in a patient. Reservoirs can be inanimate, that is, a non-living thing such as a used tourniquet or a bathtub.

Reservoirs can occur in an acute state or a carrier state. The acute state is characterized by clinical infectivity with clinical manifestation of the disease. Subclinical or asymptomatic infections are also reservoirs, but are less likely to be recognized as such. A carrier is a person who might have organisms present and may transmit an organism

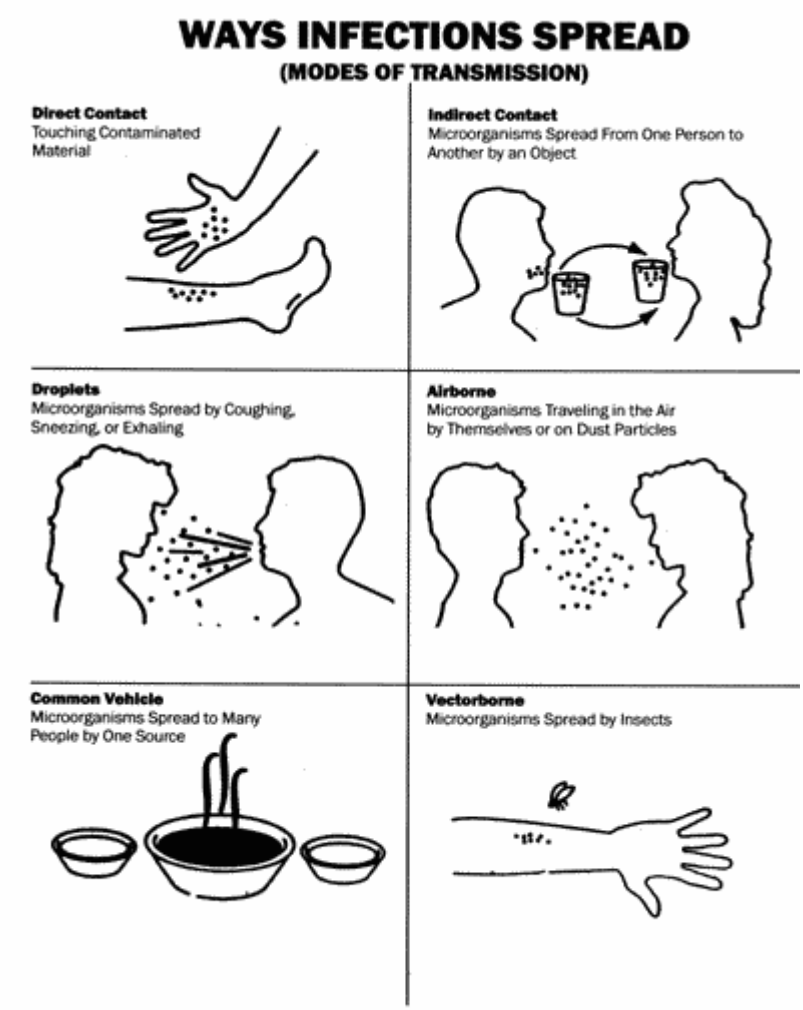
although she or he is not ill and has no symptoms. Carrier states can be chronic, convalescent or intermittent. In the chronic carrier state, a chronic pathogen is present with no sign of the disease. In the convalescent state, the acute infection is over, however, transmission of infection can continue. Transmission can also occur intermittently; the organism is shed only intermittently, rather than continuously.

Portals of exit: These are the vehicles and mechanisms by which pathogens leaves a reservoir in the body. Portals of exit include:

- Respiratory or oral secretions
- Draining lesions
- Diarrhea
- Drainage of blood and other body substances

Means of transmission: is any mechanism by which a pathogen is spread by a source or reservoir to a susceptible host. There are 5 main routes of transmission:

- **Contact transmission** is the most important and frequent mode of transmission of nosocomial infections in hospitals; it is divided into two subgroups: direct-contact transmission and indirect-contact transmission.
    - Direct Contact: involves a direct body surface-to-body surface contact and physical transfer of microorganisms between a susceptible host and an infected or colonized person, such as occurs when a healthcare provider turns a patient, gives a patient a bath, or performs other patient-care activities that require direct personal contact. Direct-contact transmission also can occur between two patients, with one serving as the source of the infectious microorganisms and the other as a susceptible host. Direct contact involves any actual physical contact between people; person to person spread such as through shaking hands.
    - Indirect Contact: involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, such as contaminated instruments, needles, or dressings, or contaminated hands that are not washed and gloves that are not changed between patients.
- **Droplet transmission** - Theoretically, is a form of contact transmission. However, the mechanism of transfer of the pathogen to the host is quite distinct from either direct- or indirect-contact transmission. Droplets are generated from the source person primarily during coughing, sneezing, and talking, and during the performance of certain procedures such as suctioning and bronchoscopy. Transmission occurs when droplets containing microorganisms generated from the infected person are propelled a short distance through the air and deposited on the host's conjunctivae, nasal mucosa, or mouth. Droplets do not remain suspended in the air, so special air handling and ventilation are not required to prevent droplet transmission; droplet transmission must not be confused with airborne transmission.



- **Airborne transmission** - occurs by dissemination of either airborne droplet nuclei (small-particle residue of evaporated droplets containing microorganisms that remain suspended in the air for long periods of time) or dust particles containing the infectious agent. Microorganisms carried in this manner can be dispersed widely by air currents and may become inhaled by a susceptible host within the same room or over a longer distance from the source patient, depending on environmental factors; therefore, special air handling and ventilation are required to prevent airborne transmission.
- **Common Vehicle** - pathogen contaminates a material, product or substance that serves as an intermediate means by which an infectious agent is transported to two or more susceptible hosts. This can be items such as food, water, medications, devices, and equipment.
- **Vectorborne** - pathogen is mechanically transmitted to a host by contact with insects, rodents or other vermin, for example a deer tick which spreads Lyme Disease.

Portals of Entry: sites and mechanisms by which pathogens are introduced to the host.

- **Entry Sites -** where the microorganism is introduced onto or into the host e.g., mucous membranes, non-intact skin, gastrointestinal, respiratory, genitourinary tracts, placenta.
- **Mechanical Introduction –** The pathogen is carried on an object that breaks integrity of the normal host defenses, e.g., percutaneous injury, vascular access and other invasive

devices, surgical incision, permucosal contact.

Susceptible Host: a person who lacks effective resistance to particular pathogenic microorganism. This lack of resistance is influenced by genetics, hormonal factors, nutritional factors, age, and behavioral patterns.

Factors Influencing Outcome of Exposure

A variety of factors influence the outcome of an exposure: impairment of host defenses, virulence of the pathogen, size of the inoculum, route of exposure and duration of the exposure.

Impairment of host defenses can include factors such as advanced age, prematurity or chronic disease. This can be mediated by changes in natural barriers, such as:

- Mechanical barriers like intact skin, which is the first line of defense.
- Respiratory cilia act to remove organisms that invade respiratory tract. Mucous serves to entrap and remove the pathogen.
- Gastric acid acts upon bacteria.
- Tears wash away potential contaminants from the eyes.

Alterations in the immune system of the host also mediate the outcome of an exposure. This can include:

- Inflammatory response, e.g., neutrophils
- Humoral immunity, e.g., antibodies
- Cell-mediated immunity, e.g., macrophages, T-cell lymphocytes

The virulence of the pathogenic organism also impacts the strength of the pathogen or power to cause infection. The more virulent the organism the less is needed to cause infection. The size of inoculum is another factor; the larger the size, the greater the exposure. The route of exposure impacts the outcome of an exposure. For example, if a healthcare worker is talking to a patient with hepatitis C, (which is spread through contact with blood and blood products), and the only route of exposure is through droplets, then the route of this exposure will likely have minimal possibility of infection to the healthcare worker. The duration of the exposure is another factor; the longer the exposure, the greater the risk of infection.

Prevention: Breaking the "Chain of Transmission"

The recognition and control of reservoirs is the first step in breaking the chain of infection. Recognition includes observing for signs and symptoms of disease, such as a fever, redness, pain or swelling. Diagnostic testing, including laboratory, radiological and other testing or procedures may be helpful in detecting infection in a reservoir.

Controlling the reservoir can include antimicrobial therapy such as antibiotics. It can also include eliminating or controlling inanimate environments that support the growth of pathogenic organisms. For example, eliminating standing water where mosquitoes breed can help to decrease the numbers of adult mosquitoes that can spread the West Nile Virus.

Prevention includes the control of the routes of transmission:

- Hand hygiene – either soap and water or waterless antibacterials (discussed in detail below).

- Use of barriers such as personal protective equipment - gloves, masks, goggles, etc.

- Sterilization or disinfection of patient care equipment.

- Precautions, Isolation or Cohorting - consider all patients as potentially infectious; use universal precautions at all times; implement other precautions as necessary; isolation is the separation of individuals to decrease the risk of transmission of specific pathogens. Cohorting is placing patients with the same infection in the same room (discussed in further detail below).

- Environmental practices – Organizational policies and procedures must be specific and followed. Element III of this mandatory infection control training addresses this in detail. Some examples include: housekeeping, ventilation which provides for adequate exchange patterns, waste management, linen and laundry management.

- Support and protection of the host includes vaccination/immunization, for example: influenza, hepatitis B, MMR, pneumococcal, DPT, HIB, and Polio. Pre and post-exposure prophylaxis is also included as is protecting skin and immune system integrity.

Hand Hygiene

Hand hygiene is critical. It is the single most effective means of reducing the spread of infection. The CDC (2004) reported that healthcare-associated infections were reduced when hand antisepsis was performed more frequently by hospital personnel; multiple research studies have documented that the prevalence of healthcare--associated infections decreased as adherence to recommended hand-hygiene measures improved (CDC, 2002). Guilhermetti et al. (2001) reported that the transient carriage on the hands of healthcare workers is the most frequent mode of transmission of methycillin-resistant *Staphylococcus aureus* (MRSA) in hospitals. Drusin, et al. (2000) studied an outbreak of nosocomial ringworm in a neonatal intensive care unit. It was discovered that a nurse, who had a rash on her hands that was infected with *Microsporum canis* due to a scratch from her cat, was the index case. She was spreading the infection through direct contact with patients.

Transmission of healthcare associated pathogens from one patient to another via the hands of healthcare workers requires the following sequence of events (CDC, 2002):

- Organisms present on the patient's skin, or that have been shed onto inanimate objects in close proximity to the patient, must be transferred to the hands of healthcare workers.

- These organisms must then be capable of surviving for at least several minutes on the hands of personnel.

- Next, handwashing or hand antisepsis by the worker must be inadequate or omitted entirely, or the agent used for hand hygiene must be inappropriate.

- Finally, the contaminated hands of the caregiver must come in direct contact with another patient, or with an inanimate object that will come into direct contact with the patient.

Hand hygiene is intended to decrease colonization with transient flora and includes hand washing and hand disinfection. The major groups of microorganisms found on the skin are either organisms that normally reside on it (resident flora) or they are contaminants (transient flora). Unless introduced into body tissues by trauma or medical devices such as intravenous catheters, the pathogenic potential of the resident flora is low. Transient flora, which are easily removed by hand hygiene, cause most hospital infections resulting from cross-transmission (Pittet, 2001).

Healthcare associated pathogens can be recovered not only from infected or draining wounds, but also from frequently colonized areas of normal, intact patient skin. The perineal or inguinal areas are usually most heavily colonized, but the axillae, trunk, and upper extremities (including the hands) also are frequently colonized (CDC, 2002). However, even in the execution of "clean activities" such as touching a patient's hand, lifting a patient, taking a pulse, temperature or blood pressure reading can put the healthcare worker at risk for contamination with the following organisms: *Staphylococcus aureus, Proteus mirabilis, Klebsiella spp., Acinetobacter spp., Enterococci, and Clostridium difficile*, among others (CDC, 2002).

Barriers to Hand Hygiene

Despite this elemental intervention, one that most healthcare professionals learned early in their educational programs, many healthcare workers do not attend to strict hand hygiene procedures.

According to the CDC (2002), a variety of factors influence adherence to hand hygiene procedures:

Observed risk factors for poor adherence to recommended hand hygiene practices (CDC, 2002)

- Physician (rather than nurse)
- Nursing assistant (rather than nurse)
- Male gender
- Working in an intensive care unit
- Working during the week (versus the weekend)
- Wearing gowns and gloves
- Automated sink
- Activities with high risk of cross contamination
- High number of opportunities for hand hygiene per hour of patient care

Self reported factors to poor adherence to hand hygiene (CDC, 2002)

- Handwashing agents cause irritation and dryness
- Sinks are inconveniently located/shortage of sinks
- Lack of soap and paper towels
- Often too busy/insufficient time
- Understaffing/overcrowding
- Patient needs take priority
- Hand hygiene interferes with healthcare worker relationship with patients
- Low risk of acquiring infections from patients
- Wearing of gloves/belief that glove use obviates the need for hand hygiene

- Lack of knowledge of guidelines, protocols
- Not thinking about it/forgetfulness
- No role model from colleagues or superiors
- Skepticism regarding the value of hand hygiene
- Disagreement with the recommendations
- Lack of scientific information of definitive impact of improved hand hygiene on healthcare associated infection rates

Additional perceived barriers to hand hygiene (CDC, 2002):

- Lack of active participation in hand hygiene promotion at the individual or institutional level
- Lack of role model for hand hygiene
- Lack of institutional priority for hand hygiene
- Lack of administrative sanction for noncompliers/rewarding compliers
- Lack of institutional safety climate

Hand Hygiene and Handwashing Terms

A variety of hand hygiene and handwashing agents are available and a variety of terms are used to describe their benefits. They include (CDC, 2002):

Alcohol-based hand rub*.* An alcohol-containing preparation designed for application to the hands for reducing the number of viable microorganisms on the hands. In the United States, such preparations usually contain 60%--95% ethanol or isopropanol.

Antimicrobial soap. Soap (i.e., detergent) containing an antiseptic agent.

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

Antiseptic handwash*.* Washing hands with water and soap or other detergents containing an antiseptic agent.

Antiseptic hand rub. Applying an antiseptic hand-rub product to all surfaces of the hands to reduce the number of microorganisms present.

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

Decontaminate hands*.* To Reduce bacterial counts on hands by performing antiseptic hand rub or antiseptic handwash.

Detergent. Detergents (i.e., surfactants) are compounds that possess a cleaning action. They are composed of both hydrophilic and lipophilic parts and can be divided into four groups: anionic, cationic, amphoteric, and nonionic detergents. Although products used for handwashing or antiseptic handwash in healthcare settings represent various types of detergents, the term "soap"

is used to refer to such detergents in this guideline.

Hand antisepsis. Refers to either antiseptic handwash or antiseptic hand rub.

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

Handwashing. Washing hands with plain (i.e., non-antimicrobial) soap and water.

Persistent activity*.* Persistent activity is defined as the prolonged or extended antimicrobial activity that prevents or inhibits the proliferation or survival of microorganisms after application of the product. This activity may be demonstrated by sampling a site several minutes or hours after application and demonstrating bacterial antimicrobial effectiveness when compared with a baseline level. This property also has been referred to as "residual activity." Both substantive and nonsubstantive active ingredients can show a persistent effect if they substantially lower the number of bacteria during the wash period.

Plain soap. Plain soap refers to detergents that do not contain antimicrobial agents or contain low concentrations of antimicrobial agents that are effective solely as preservatives.

Substantivity. Substantivity is an attribute of certain active ingredients that adhere to the stratum corneum (i.e., remain on the skin after rinsing or drying) to provide an inhibitory effect on the growth of bacteria remaining on the skin.

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

Visibly soiled hands*.* Hands showing visible dirt or visibly contaminated with proteinaceous material, blood, or other body fluids (e.g., fecal material or urine).

Waterless antiseptic agent. An antiseptic agent that does not require use of exogenous water. After applying such an agent, the hands are rubbed together until the agent has dried.

The term **hand hygiene** includes several actions intended to decrease colonization with transient flora. This objective can be achieved through handwashing or hand disinfection. **Handwashing** refers to washing hands with an unmedicated detergent and water or water alone. Its objective is to prevent cross-transmission by removing dirt and loose transient flora. **Hygienic handwash** refers to the same procedure when an antiseptic agent is added to the detergent**. Hand disinfection** refers to the use of an antiseptic solution to clean the hands, either medicated soap or alcohol. Some experts refer to the action of "degerming" as the use of detergent-based antiseptics or alcohol. Hygienic hand rub is rubbing hands with a small quantity (2 to 3 mL) of a highly effective, fast-acting antiseptic agent (Pittet, 2001).

Hand hygiene with unmedicated soap and water removes some transient flora mechanically; preparations containing antiseptic or antimicrobial agents not only remove flora mechanically but also chemically kill contaminating and colonizing flora, with long-term residual activity. Alcohol-based preparations have more rapid action than products containing other antiseptics (e.g., chlorhexidine gluconate or providone iodine) (Pittet, 2001).

Because alcohols have excellent activity and the most rapid bactericidal action of all antiseptics, they are the preferred agents for hygienic hand rubs, so-called "waterless hand disinfection." In addition, alcohols are more convenient than aqueous solutions for hygienic hand rubs because of their excellent spreading quality and rapid evaporation. At equal concentrations, n-propanol is the most effective alcohol and ethanol the least. Alcohol-based hand rubs are well suited for hygienic hand disinfection for the following reasons: optimal antimicrobial spectrum (active against all

bacteria and most clinically important viruses, yeasts, and fungi); no wash basin necessary for use and easy availability at bedside; no microbial contamination of health-care workers' clothing; and rapidity of action. After extensive reduction following hand disinfection with an alcohol preparation, it takes the resident skin flora several hours to become completely restored. Since alcohol alone has no lasting effect, another compound with antiseptic activity may be added to the disinfection solution to prolong the effect (Pittet, 2001)

The selection of correct hand washing agents should be based on the task performed. In non-patient areas, plain soap is satisfactory. This provides for the physical removal of transient flora; it does not kill microorganisms, but suspends them so they are easily washed/rinsed off. In high-risk areas, maximum reduction of bacterial counts is needed, so antimicrobial or antiseptic agent must be used to reduce colonizing flora.

Hand Hygiene Efficacy

Factors which influence hand hygiene efficacy:

- Mechanical friction is needed to remove gross contamination.
- Warm running water rinses away loosened debris and organisms.
- Soap removes matter by emulsifying oils that hold organisms. Soap comes in many forms and provides opportunity to reduce exposures; however soap can also be a source of potential contamination or cross-contamination. Bars of soap might sit in pools of stagnating water. Small bars and disposal of used bars is recommended. Refillable soap dispensers should not be “topped off." They must be emptied and cleaned before refilling. Disposable, non-refillable dispensers are preferable.
- Avoid using agents which cause excessive dryness, cracking and dermatitis, as this discourages workers from washing hands as often, as well as providing a break in intact skin and increasing the risk of infection spread.
- Locate sinks close to area where care is delivered.
- Have designated hand-washing sinks.
- Have foot, knee or elbow pedals when possible.
- Wash before and after any patient contact even if gloves are worn.
- Wash hands whenever they become soiled with potentially infectious material.
- Wash after touching contaminated matter.
- Use waterless, alcohol based agents when water is unavailable; wash hands with soap and water as soon as possible afterwards.

Isolation Precautions

According the Hospital Infection Control Practices Advisory Committee (HICPAC) (Garner, 1996), there are two tiers of isolation precautions: Standard Precautions and Transmission-based precautions. Standard Precautions are those precautions designed for the care of all patients in hospitals, regardless of their diagnosis or presumed infection status. Implementation of these "Standard Precautions" is the primary strategy for successful nosocomial infection control. In the second tier are precautions designed only for the care of specified patients. These additional "Transmission-Based Precautions" are for patients known or suspected to be infected by

epidemiologically important pathogens spread by airborne or droplet transmission or by contact with dry skin or contaminated surfaces.

Standard Precautions synthesize the major features of Universal Precautions (Blood and Body Fluid Precautions designed to reduce the risk of transmission of bloodborne pathogens) and Body Substance Isolation (designed to reduce the risk of transmission of pathogens from moist body substances) and applies them to all patients receiving care in hospitals, regardless of their diagnosis or presumed infection status. Standard Precautions apply to

- blood;
- all body fluids, secretions, and excretions *except sweat*, regardless of whether or not they contain visible blood;
- nonintact skin; and
- mucous membranes.

Standard Precautions are designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infection in hospitals. Because a healthcare worker cannot always know when a patient's body fluids are infectious, standard precautions should be used with all patients in the healthcare setting, regardless of their infection status. Standard precautions are designed to prevent unprotected contact between the healthcare worker and

- Blood and all body fluids whether or not they contain blood;

- Mucous membranes.

When a specific diagnosis is made, additional precautions are taken based on how the specific disease is transmitted. **Transmission-Based Precautions** are designed for patients documented or suspected to be infected with highly transmissible or epidemiologically important pathogens for which additional precautions beyond Standard Precautions are needed to interrupt transmission in hospitals. There are three types of Transmission-Based Precautions: Airborne Precautions, Droplet Precautions, and Contact Precautions. They may be combined for diseases that have multiple routes of transmission. When used either singularly or in combination, they are to be used in addition to Standard Precautions.

- **Airborne Precautions** are designed to reduce the risk of airborne transmission of infectious agents. Airborne Precautions apply to patients known or suspected to be infected with epidemiologically important pathogens that can be transmitted by the airborne route.

  In addition to Standard Precautions, use Airborne Precautions, or the equivalent, for patients known or suspected to be infected with microorganisms transmitted by airborne droplet nuclei (small-particle residue [5 μm or smaller in size] of evaporated droplets containing microorganisms that remain suspended in the air and that can be dispersed widely by air currents within a room or over a long distance).

  Place the patient in a private room that has

  1) monitored negative air pressure in relation to the surrounding areas,

  2) 6 to 12 air changes per hour, and

  3) appropriate discharge of air outdoors or monitored high-efficiency filtration of room air before the air is circulated to other areas in the hospital.

  Keep the room door closed and the patient in the room. When a private room is not available, place the patient in a room with a patient who has active infection with the same microorganism, unless otherwise recommended, but with no other infection. When

a private room is not available and cohorting is not desirable, consultation with infection control professionals is advised before patient placement.

Wear respiratory protection (N95 respirator) when entering the room of a patient with known or suspected infectious pulmonary tuberculosis. Susceptible persons should not enter the room of patients known or suspected to have measles (rubeola) or varicella (chickenpox) if other immune caregivers are available. If susceptible persons must enter the room of a patient known or suspected to have measles (rubeola) or varicella, they should wear respiratory protection (N95 respirator). Persons immune to measles (rubeola) or varicella need not wear respiratory protection.

Limit the movement and transport of the patient from the room to essential purposes only. If transport or movement is necessary, minimize patient dispersal of droplet nuclei by placing a surgical mask on the patient, if possible.

- **Droplet Precautions** are designed to reduce the risk of droplet transmission of infectious agents.

  In addition to Standard Precautions, use Droplet Precautions, or the equivalent, for a patient known or suspected to be infected with microorganisms transmitted by droplets (large-particle droplets [larger than 5 µm in size] that can be generated by the patient during coughing, sneezing, talking, or the performance of procedures).

  Place the patient in a private room. When a private room is not available, place the patient in a room with a patient(s) who has active infection with the same microorganism but with no other infection (cohorting). When a private room is not available and cohorting is not achievable, maintain spatial separation of at least 3 feet between the infected patient and other patients and visitors. Special air handling and ventilation are not necessary, and the door may remain open.

  In addition to wearing a mask as outlined under Standard Precautions, wear a mask when working within 3 feet of the patient. (Logistically, some hospitals may want to implement the wearing of a mask to enter the room.)

  Limit the movement and transport of the patient from the room to essential purposes only. If transport or movement is necessary, minimize patient dispersal of droplets by masking the patient, if possible.

- **Contact Precautions** are designed to reduce the risk of transmission of epidemiologically important microorganisms by direct or indirect contact. Contact Precautions apply to specified patients known or suspected to be infected or colonized (presence of microorganism in or on patient but without clinical signs and symptoms of infection) with epidemiologically important microorganisms than can be transmitted by direct or indirect contact.

  In addition to Standard Precautions, use Contact Precautions, or the equivalent, for specified patients known or suspected to be infected or colonized with epidemiologically important microorganisms that can be transmitted by direct contact with the patient (hand or skin-to-skin contact that occurs when performing patient-care activities that require touching the patient's dry skin) or indirect contact (touching) with environmental surfaces or patient-care items in the patient's environment.

  Place the patient in a private room. When a private room is not available, place the patient in a room with a patient(s) who has active infection with the same microorganism but with no other infection (cohorting). When a private room is not available and cohorting is not achievable, consider the epidemiology of the microorganism and the patient

population when determining patient placement. Consultation with infection control professionals is advised before patient placement.

In addition to wearing gloves as outlined under Standard Precautions, wear gloves (clean, nonsterile gloves are adequate) when entering the room. During the course of providing care for a patient, change gloves after having contact with infective material that may contain high concentrations of microorganisms (fecal material and wound drainage). Remove gloves before leaving the patient's room and wash hands immediately with an antimicrobial agent or a waterless antiseptic agent. After glove removal and handwashing, ensure that hands do not touch potentially contaminated environmental surfaces or items in the patient's room to avoid transfer of microorganisms to other patients or environments.

In addition to wearing a gown as outlined under Standard Precautions, wear a gown (a clean, nonsterile gown is adequate) when entering the room if you anticipate that your clothing will have substantial contact with the patient, environmental surfaces, or items in the patient's room, or if the patient is incontinent or has diarrhea, an ileostomy, a colostomy, or wound drainage not contained by a dressing. Remove the gown before leaving the patient's environment. After gown removal, ensure that clothing does not contact potentially contaminated environmental surfaces to avoid transfer of microorganisms to other patients or environments.

Limit the movement and transport of the patient from the room to essential purposes only. If the patient is transported out of the room, ensure that precautions are maintained to minimize the risk of transmission of microorganisms to other patients and contamination of environmental surfaces or equipment.

When possible, dedicate the use of noncritical patient-care equipment to a single patient (or cohort of patients infected or colonized with the pathogen requiring precautions) to avoid sharing between patients. If use of common equipment or items is unavoidable, then adequately clean and disinfect them before use for another patient.

Cohorting is another system in which individuals infected with the same organism room together. It is important to transfer or discharge infected individuals if unable to provide adequate precautions or isolation strategies. Segregation of symptomatic individuals is another approach to preventing the spread of infection. Patients with some diseases transmitted exclusively or in part by airborne route, patients who soil articles in the environment with body substances and patients colonized or infected with organisms that are multidrug resistant may be subject to this kind of isolation.

Hospitals and other healthcare organizations have specific policies and procedures regarding the various precautions and isolations systems. Healthcare workers must know and follow their agency's policies and procedures. Infection control departments in healthcare settings are generally available for consultation.

Element III: Engineering and Work Practice Controls

This third element of the New York State mandatory infection control training, addresses the use of engineering and work practice controls to reduce the opportunity for patient and healthcare worker exposure to potentially infectious material.

Engineering Controls

Engineering Controls are also called environmental controls; they are interventions that by design and function remove or isolate the healthcare worker and the patient from the hazard. This includes: puncture resistant sharps disposal containers, needleless systems, air exchange ventilation systems, directional air flows.

Personal Protective Equipment (PPE) includes all of the supplemental protection that is utilized if risk of exposure still exists. Examples of personal protective equipment include gloves, masks, gowns, and eye wear. Element IV of this mandatory infection control training addresses personal protective equipment in detail; it appears later in this course.

Healthcare workers use many types of needles and other sharp devices and equipment to provide patient care. Estimates indicate that between 600,000 to 800,000 healthcare workers annually are exposed to percutaneous injuries (NIOSH, 1999). Of the over 8 million healthcare workers, most reported needlestick injuries involve nursing staff; but laboratory staff, physicians, housekeepers, and other health care workers are also injured. Among medical students and residents, the most common percutaneous injury is from suture needles (International Health Care Worker Safety Center, 2000)

Despite the frequency of percutaneous injuries, data from hospitals participating in the CDC National Surveillance System for Hospital Healthcare Workers (NaSH) and from hospitals included in the EPINet research database (from the International Health Care Worker Safety Center [IHCWSC] at the University of Virginia) show that only a few needles and other sharp devices are associated with the majority of injuries (IHCWSC, 1997; EPINet, 1999; CDC unpublished data, 1999). Of the percutaneous injuries reported by hospitals participating in NaSH between June 1995 and July 1999, 62% were associated with hollow-bore needles—primarily hypodermic needles attached to disposable syringes (29%) and winged-steel (butterfly-type) needles (13%). Figure 1 shows the extent to which these and other sharp devices contributed to the burden of percutaneous injuries in NaSH hospitals. Data from hospitals participating in EPINet show a similar distribution of injuries by device type (EPINet, 1999).

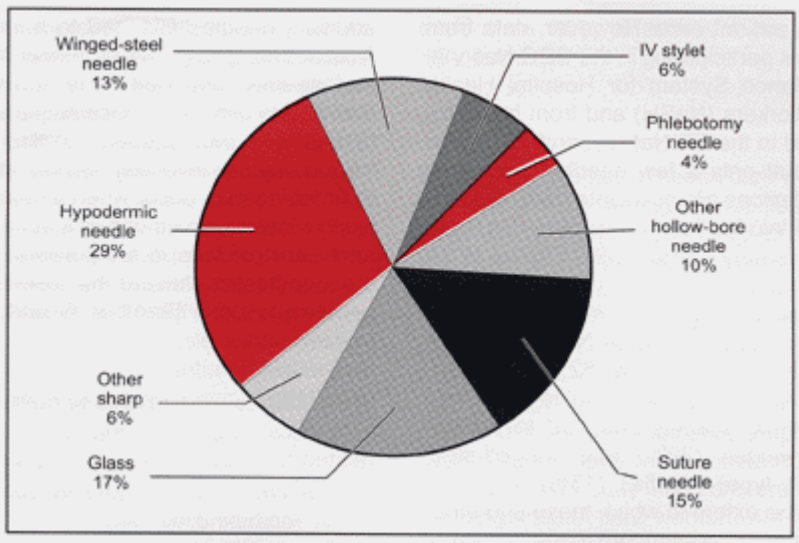


Figure 1. Hollow-bore needles and other devices associated with percutaneous injuries in NaSH hospitals, by % total percutaneous injuries (n=4,951), June 1995 - July 1999. (Source: CDC [1999].)

The circumstances leading to a needlestick injury depend partly on the type and design of the device used. For example, needle devices that must be taken apart or manipulated after use (e.g., prefilled cartridge syringes and phlebotomy needle/vacuum tube assemblies) are an obvious hazard and have been associated with increased injury rates (Jagger et al., 1998). In addition, needles attached to a length of flexible tubing (e.g., winged-steel needles and needles attached to IV tubing) are sometimes difficult to place in sharps containers and thus present another injury hazard. Injuries involving needles attached to IV tubing may occur when a healthcare worker inserts or withdraws a needle from an IV port or tries to temporarily remove the needlestick hazard by inserting the needle into a drip chamber, IV port or bag, or even bedding.

There is some good news however, rates of percutaneous injury seem to be decreasing. Accumulating evidence indicates that devices with safety features reduce needlestick injuries:

- Needleless or protected-needle IV systems decreased needlestick injuries related to IV connectors by 62% to 88% (Gartner, 1992; Yassi, et al., 1995; Lawrence,et al., 1997);
- Phlebotomy injuries were reduced by 76% with a self-blunting needle, 66% with a hinged needle shield, and 23% with a sliding-shield, winged-steel (butterfly-type) needle (CDC, 1997a);
- Phlebotomy injuries were reduced by 82% with a needle shield, but a recapping device had minimal impact (Billier, et al., 1991);
- Safer IV catheters that encase the needle after use reduced needlestick injuries related to IV insertion by 83% in three hospitals (Jagger, 1996).

Data from the EPINet Surveillance System of International Healthcare Worker Safety Center at the University of Virginia for 1999 identified a total of 2,025 percutaneous injuries among the 21 facilities participating in the EPINet surveillance. There was a percutaneous injury rate of 40 per 100 occupied patient beds in teaching hospitals and a rate of 34 per 100 occupied patient beds in non-teaching hospitals (Perry, Parker and Jagger, 2003). In 2001, there were a total of 1,929 percutaneous injuries among the facilities participating in the EPINet surveillance system. The average percutaneous injury rate in teaching hospitals was 26 in 100 occupied patient beds, and a rate of 18 in 100 occupied patient beds in non-teaching hospitals (Perry, Parker and Jagger, 2003). The reduction in percutaneous injury rates can be attributed to a number of factors, foremost is the 1999 Revision of the OSHA Bloodborne Pathogen Standard, and the 2000 Needlestick Safety and Prevention Act. As mentioned earlier in this course, OSHA has issued citations to healthcare facilities for not utilizing engineering controls in the form of sharps with engineered sharps injury protections that remove or isolate bloodborne pathogen hazards from the workplace when injecting medications or utilizing catheters or other medical devices. These citations, with their accompanying fines have contributed to the reduction in percutaneous injuries.

Additional factors that may have contributed to the decrease in needlestick injuries are increased education of healthcare workers related to the risks associated with sharps injuries, and increased training in the proper use of safety devices (Perry, Parker and Jagger, 2003).

Safer Devices: Desirable Characteristics

Improved engineering controls are often among the most effective approaches to reducing occupational hazards related to infection control. Such controls include eliminating the unnecessary use of needles and implementing devices with safety features. A number of sources have identified the desirable characteristics of safety devices (OSHA, 1999c; FDA, 1992;

Jagger, et al., 1988; Chiarello, 1995; Quebbeman and Short, 1995; Pugliese, 1998; Fisher, 1999; ECRI, 1999). These characteristics include the following:

- The device is needleless.
- The safety feature is an integral part of the device.
- The device preferably works passively (i.e., it requires no activation by the user). If user activation is necessary, the safety feature can be engaged with a single-handed technique and allows the worker's hands to remain behind the exposed sharp.
- The user can easily tell whether the safety feature is activated.
- The safety feature cannot be deactivated and remains protective through disposal.
- The device performs reliably.
- The device is easy to use and practical.
- The device is safe and effective for patient care.

Although each of these characteristics is desirable, some are not feasible, applicable or available for certain healthcare situations. For example, needles will always be necessary where alternatives for skin penetration are not available. Also, in some cases a safety feature that requires activation by the user might be preferable to one that is passive. Each device must be considered on its own merit and ultimately on its ability to reduce the risk of exposure. The desirable characteristics listed above should serve only as a guideline for device design and selection.

Examples of safety device designs:

- Needleless connectors for IV delivery systems (e.g., blunt cannula for use with prepierced ports and valved connectors that accept tapered or luer ends of IV tubing);
- Protected needle IV connectors (e.g., the IV connector needle is permanently recessed in a rigid plastic housing that fits over IV ports);
- Needles that retract into a syringe or vacuum tube holder;
- Hinged or sliding shields attached to phlebotomy needles, winged-steel needles, and blood gas needles;
- Protective encasements to receive an IV stylet as it is withdrawn from the catheter;
- Sliding needle shields attached to disposable syringes and vacuum tube holders;
- Self-blunting phlebotomy and winged-steel needles (a blunt cannula seated inside the phlebotomy needle is advanced beyond the needle tip before the needle is withdrawn from the vein);
- Retractable finger/heel-stick lancets;
- Blunt suture needles;
- Mechanical pipette.

As illustrated by the examples listed here, many devices with safety features decrease the frequency of needlestick injuries, but for many reasons they do not completely eliminate the risk.

In some cases the safety feature cannot be activated until after the needle is removed from the patient or the needle may be inadvertently dislodged during a procedure, thereby exposing the unprotected sharp. Some healthcare workers fail to activate the safety feature, or the safety feature may fail. With some devices, users can bypass safety features. For example, even with some needleless IV delivery systems, a needle can be used to connect parts of the system. Understanding the factors that influence the safety of a device and promoting practices that will maximize prevention effectiveness are important components in prevention planning. Even devices with safety features must be utilized properly in order to be effective. Practices that the healthcare provider engages in that derail the safety device or ignore the safety device will be covered later, in the section of this course on work practice controls.

Selecting/Evaluating Needle Devices

An increasing number and variety of needle devices with safety features are now available, but many of these devices have had only limited use in the workplace. Healthcare organizations and workers may find it difficult to select appropriate devices. Although these devices are designed to enhance the safety of healthcare workers, they should be evaluated to ensure that:

- The safety feature works effectively and is reliable;
- The device is acceptable to the healthcare worker; and
- The device does not adversely affect patient care.

As employers implement the use of needle devices with safety features, they can use several guidelines to select and evaluate these products. These guidelines are derived partly from publications and other resources offering plans, evaluation forms and related information in this new area (Chiarello, 1995; Fisher, 1999; SEIU, 1998; EPINet, 1999; Pugliese and Salahuddin, 1999). While healthcare settings are implementing the use of needle devices with safety features, they should seek help from the appropriate professional organizations, trade groups and manufacturers in obtaining information about devices and procedures suitable for specific settings (e.g. dental offices). Other information sources are listed in the "Resources" section of this course.

The major elements of a process for selecting and evaluating needle devices with safety features are listed below:

1. Form a multidisciplinary team that includes workers to
    - Develop, implement, and evaluate a plan to reduce needlestick injuries in the institution; and
    - Evaluate needle devices with safety features.
2. Identify priorities based on assessments of how needlestick injuries are occurring, patterns of device use in the institution, and local and national data on injury and disease transmission trends. Give the highest priority to needle devices with safety features that will have the greatest impact on preventing occupational infection (e.g., hollow-bore needles used in veins and arteries).
3. When selecting a safer device, identify its intended scope of use in the healthcare facility and any special technique or design factors that will influence its safety, efficiency, and user acceptability. Seek published, Internet, or other sources of data on the safety and overall performance of the device.
4. Conduct a product evaluation, making sure that the participants represent the scope of eventual product users. The following steps will contribute to a successful product evaluation:
    - Train healthcare workers in the correct use of the new device.
    - Establish clear criteria and measures to evaluate the device with regard to both healthcare worker safety and patient care. (Safety feature evaluation forms are available from the references cited earlier).
    - Conduct onsite followup to obtain informal feedback, identify problems, and provide additional guidance.

5. Monitor the use of a new device after it is implemented to determine the need for additional training, solicit informal feedback on healthcare worker experience with the device (e.g., using a suggestion box), and identify possible adverse effects of the device on patient care.

Ongoing review of current devices and options will be necessary. As with any evolving technology, the process will be dynamic, and with experience, improved devices with safety features will emerge.

The International Health Care Worker Safety Center, at the University of Virginia (2003) has compiled a list of safety-engineered sharp devices and other products designed to prevent occupational exposures to bloodborne pathogens. To access this list, go to http://www.healthsystem.virginia.edu/internet/epinet/safetydevice.cfm.

Although the focus in this section is on needle devices with safety features, sharps disposal containers are also important engineering controls to consider in a comprehensive needlestick injury prevention program.

Sharps Disposal Containers

NIOSH (1998) has determined that sharps disposal containers can be evaluated on four criteria: functionality, accessibility, visibility and accommodation.

Functionality

Containers should remain functional during their entire usage. They should be durable, closable, leak resistant on their sides and bottoms, and puncture resistant under normal use and stresses imposed during storage, handling, installation, use, closure, and transport within the user facility before final disposal until final disposal. If present, handles should be sufficiently sturdy to avoid breaking when the sharps disposal container is in use or during transportation before final disposal. A sufficient number of sharps disposal containers should be provided. Individual containers should have adequate volume and safe access to the disposal opening (inlet).

Closure mechanisms should be designed to minimize exposure to contents and injury to the hand during engagement of the closure mechanism or during transport within the user facility before final disposal. Once activated, the final closure mechanism of a sharps disposal container should be resistant to manual opening.

Containers (including those designed to be kicked or wheeled) should be stable when placed on a horizontal surface and when used as described in the product labeling. Some manufacturers provide trays, holders, or enclosures to stabilize their containers in certain applications. The use of these items should also be detailed in the labeling.

A sufficient quantity of sharps disposal containers should be available in the appropriate size and shape. Sharps disposal containers should be of sufficient size to accommodate the largest sharp used at the workstation it serves. Containers should also be shaped to accommodate the particular type of sharp that requires disposal. At a minimum, one sharps disposal container should be provided at each worksite where sharps are predictably generated or located.

Sharps disposal containers should also be of sufficient size to accommodate the volume of sharps typically generated at the site between maintenance operations. Providing sharps disposal containers of sufficient size will minimize the possibility of overfilling the container, which would compromise its safe operation.

Accessibility

Containers should be accessible to workers who use, maintain, or dispose of sharp devices. Containers should be conveniently placed and (if necessary) portable within the workplace.

The disposal opening should prevent spills of the contents (objects or liquid) while in use in the intended upright position, during the closure and sealing process, and during transportation within the user facility before final disposal.

Security may be a concern in some areas of facilities using sharps disposal containers. For instance, to prevent children and others from putting their hands into the containers, the facility should consider selecting containers with guards that prevent hands or fingers from entering the containers. Where safety features are added to restrict child access these features should not interfere with the worker's vision of the inlet opening. Injury to visitors may also be a problem. Sharps disposal container options that accommodate these concerns should be available within the facility.

Proper sharps disposal container location and placement should ensure that containers are readily visible and within easy horizontal reach of the user. Where containers are fixed to walls or other permanent sites, the vertical height should allow the worker to view the opening or access of the container.

Sharps disposal containers should have no obstructions to their accessibility. Injuries may result if sharps disposal containers are located in awkward, unsafe locations. These unsafe locations may force workers to make unnecessary movements while holding a sharp and accessing the container. Placement of the sharps disposal container outside the patient room also increases the possibility of injury. Examples of inappropriate installation include placement in the corners of rooms; on the backs of room doors; under cabinets; on the insides of cabinet doors; under sinks; in areas where people might sit or lie beneath the container; near light switches, room environmental controls, or utility system access ways; near mail boxes; or where the container is subject to impact and dislodgement by pedestrian traffic, moving equipment, gurneys, wheelchairs, or swinging doors. Standard operating procedures and practices should be developed to allow the worker to dispose of the device as soon as possible after use—preferably without needing to put the device down and pick it up again.

Visibility

Containers should be plainly visible to the workers who use them. Workers should be able to see the degree to which the container is full, proper warning labels, and color-coding.

Sharps disposal containers should carry a hazard warning labeling. Such labels and device colors should imply danger. Either the device color or a warning label should be visible to the user to warn of a potential hazard before sharps are placed in the container. The current fill status of the container should be easily observable by the user before sharps are placed in the container. Sufficient illumination is needed at the container to determine whether any sharp object is protruding from the container or whether the container is grossly soiled at holding points or on opening mechanisms. Container fill status should be obvious under lighting conditions at the installation location. Safety features, security measures, and aesthetics should not distort recognition of the container, fill status, warning labels, or the disposal opening or access.

OSHA's bloodborne pathogens standard [29 CFR 1910.1030, section (g)(1)(I)(C)] contains very specific requirements about the labeling of containers for contaminated sharps: "These labels shall be fluorescent orange or orange-red or predominantly so, with lettering or symbols in a contrasting color." The standard also requires that the biohazard symbol and the word *Biohazard* be displayed; note, however, that "Red bags or red containers may be substituted for labels" in section (g)(1)(I)(E).

Accommodation

Sharps disposal container designs should be accommodating to the user, the facility, and the environment. Accommodation is a measurement of ease of storage and assembly, minimal worker training requirements, ease of operation, and flexibility in design. Container design should promote one-handed disposal. Design and product finish should minimize sharp surfaces or cross-infection hazards. Special aesthetic, operational, or safety features should not hide or impede free access to the device, the inlet, or the closure process. Users should be able to assemble containers easily, if required. Mounting systems should be safe, durable, stable, cleanable, and (where appropriate) lockable. Placement in and removal from mounting systems should be simple and uncomplicated and should not compromise safety and security. To ensure proper fit and functioning of the container mounting system, mounting systems should be used only for the sharps disposal containers for which they were designed. Modifying mounting systems to accommodate containers for which they were not designed is not a safe or effective practice.

Containers should be designed so that they are simple to use. Manufacturers of sharps disposal containers should provide recommended user training information.

Other environmental controls include splatter shields on medical equipment such as locking centrifuge lids.

Engineering Controls for Exposure to Airborne Pathogens - Hierarchy Concept

Although the 1992 New York State training requirement was based on infection control specifically related to bloodborne pathogens, the 2001 revision included additional requirements for airborne pathogens. Exposure to airborne pathogens occurs just by being present - contact is not necessary. However, some circumstances increase the opportunities for exposure:

- Inadequate ventilation.
- Prolonged exposure.
- Lack of source control.
- Unrecognized cases.

Implementation of adequate engineering controls helps to prevent exposure to airborne pathogens. These include:

- Adequate ventilation.
- Appropriate air exchange/ventilation.
- Negative pressure rooms/Directional airflow with air exhausted to exterior of the building.
- High Efficiency Particulate Air (HEPA) filters, e.g., isolation booths, demistifier tents.

Personal respiratory protection is also used to reduce exposure to airborne pathogens. Currently, the recommendations require use of NIOSH - approved HEPA filter particulate respirators.

Source control is an important intervention in reducing exposure to airborne pathogens. The early identification of infection, isolation and treatment are needed to control the spread of airborne pathogens. It is important to educate patients to cover the mouth when sneezing or coughing.

Triage and separation of possible infectious individuals from others at risk is important. This can be accomplished through isolation of the suspected infectious person, triaging clinic or emergency department patients.

Medical surveillance and employee health procedures are critical to the control of airborne pathogens, as well as pathogens that utilize other modes of transmission. Most acute care employers require a physical examination prior to hire, annual PPD or chest X-rays are required. Policies and procedures require employees with known or suspected infectious disease to be treated.

Adjunctive measures such as germicidal ultraviolet light can also be useful.

Work Practice Controls

In addition to risks related to device characteristics described above under engineering controls, there are risks associated with how a task is performed. Work Practice Controls, also known as administrative controls, include policies and procedures regarding work practices that reduce or eliminate the likelihood of exposure by altering the manner in which a task is performed.

Some circumstances or practices increase opportunities for exposure to infectious material; these include percutaneous exposure, mucous membrane/non-intact skin exposure and parenteral exposure.

Development and Implementation of Work Practice Controls: These include the evaluation and revision of the way in which high-risk tasks are performed, such as hand washing and respiratory protection.

Needlestick injuries have been associated with certain work practices such as

- Recapping;
- Transferring a body fluid between containers; and
- Failing to properly dispose of used needles in puncture-resistant sharps containers.

Past studies of needlestick injuries have shown that 10% to 25% occurred when recapping a used needle (Ruben, et al., 1983; Krasinski, et al., 1987; McCormick & Maki, 1981; McCormick, et al., 1991; Yassi & McGill, 1991). Although recapping by hand has been discouraged for some time and is prohibited under the OSHA bloodborne pathogens standard (19 CFR 1910.1030) unless no alternative exists, 5% of needlestick injuries in NaSH hospitals are still related to this practice (Figure 2). Injury may occur when a healthcare worker attempts to transfer blood or other body fluids from a syringe to a specimen container, such as a vacuum tube, and misses the target. Also, if used needles or other sharps are left in the work area or are discarded in a sharps container that is not puncture resistant, a needlestick injury may result.

Whenever a needle or other sharp device is exposed, injuries can occur. Data from NaSH show that approximately 38% of percutaneous injuries occur during use and 43% occur after use and before disposal. Causes of percutaneous injuries with hollow-bore needles are shown in Figure 2.

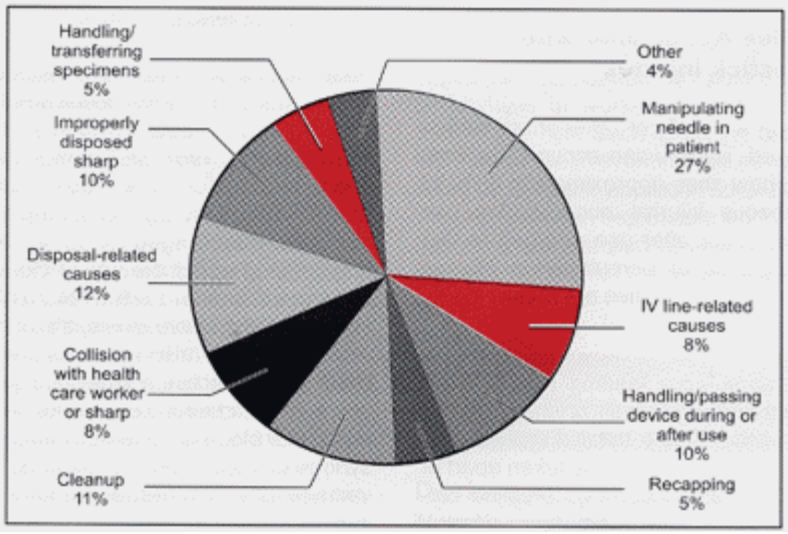


Figure 2. Causes of percutaneous injuries with hollow-bore needles in NaSH hospitals, by % total percutaneous injuries (n=3,057), June 1995 - July 1999. (Source: CDC [1999].)

Percutaneous exposures occur when the skin is pierced, causing a point of entry for blood or other infectious material. Percutaneous injury can occur through handling, disassembly, disposal, reprocessing of needles and other sharps, manipulating needles and other sharps by hand, recapping, removing scalpel blades. During some procedures, such as blind suturing, there is opportunity for injury, due to poor visualization, which can expose the patient as well as the healthcare worker. Whenever the non-dominant hand is opposing or next to a sharp or when bone spicules or metal fragments are present, the risk of percutaneous injury is greater.

Mucous membrane/non-intact skin exposures also increase the risk of exposure to infection. Direct contact with blood or body fluid can occur, as well as through splashing or sprays of blood or body fluid.

Parenteral exposures occur with injection with infectious material or an infusion of contaminated blood products. Transplantation of contaminated organs/tissues also results in parenteral exposure.

Work practice controls begin with an evaluation of the task being done to determine if it is being accomplished in the safest way possible. Work practice controls that help to reduce the risk of exposure to infections include efforts to modify procedures in order to avoid injury. Some examples include:

- Utilizing a safer device whenever possible
- Passing sharp instruments by use of designated "safe zones".
- Disassembling sharp equipment by use of forceps or other devices.
- Using forceps, suture holder, or other instruments for suturing.
- Using forceps rather than fingers for holding tissue.
- Not leaving sharps on a field.
- Hand washing.
- Prompt cleaning of blood and body fluid spills.

- Containing the spill so that exposure to other individuals, equipment, or instruments is prevented until cleaned up.

- Wearing appropriate personal protective equipment (PPE) - gloves are mandatory, gowns/aprons are used depending on extent of spill.

- Wiping up blood with disposable cloth, pour diluted bleach solution (1/4 cup household bleach to 1 gallon water) or other EPA approved agent directly onto the surface, let sit 10 minutes, then wipe with second disposable cloth.

- Bagging the medical waste according to policy and procedure in your facility; the bag should be labeled with biohazard sign.

- Worker training and education, for example, this New York State mandatory training in infection control for licensure or relicensure certain health professionals, as well as annual reviews in most healthcare facilities.

- Monitoring for safe work practices. This is not only an individual professional responsibility, but also quality assurance; risk management and health and safety committees are among those responsible for safe work practices.

Identifying Those at Risk for Exposure

Those at risk for exposure include healthcare workers who are performing a procedure, any assistants in a procedure, those who are near or are observing the performance of a procedure and ancillary personnel. Based on this definition, most of the more than 8 million healthcare workers in the United States are at risk for exposure.

Between 1985 and 2000 (the most current available information), 56 “documented” cases and 138 “possible” cases of occupational Human Immunodeficiency Virus (HIV) transmission cases were reported to the Centers for Disease Control and Prevention (CDC, 2000) (See Table 1). Nurses and laboratory technicians were most often involved. Percutaneous injury, or needlestick injury, accounted for 49 (89%) of the documented transmissions. Of these, 44 involved hollow-bore needles used for blood collection or insertion of an IV catheter (NIOSH, 1999).

Multiple studies have been conducted to estimate the rate of HIV transmission to workers who were exposed to HIV infected blood through percutaneous injury. Of 6,498 exposures studied, 21 infections followed, for an average transmission rate of 0.3% per injury. Additionally, studies have indicated that the risk of HIV transmission increased when the worker was exposed to a large quantity of blood from a patient, as indicated by (1) a visibly bloody device, (2) a procedure that involved placing a needle in a patient’s vein or artery, or (3) a deep injury (NIOSH, 1999).

Table 1. Healthcare workers with documented and possible occupationally acquired AIDS/HIV infection, by occupation, reported through June 2000, United States[1]

Occupation	Documented Occupational Transmission2	Possible Occupational Transmission3
Dental worker, including dentist	--	6
Embalmer, morgue technician	1	2
Emergency medical technician, paramedic	--	12
Health aide, attendant	1	15
Housekeeper/maintenance worker	2	13
Laboratory technician, clinical	16	17
Laboratory technician, non-clinical	3	--
Nurse	23	35
Physician, non-surgical	6	12
Physician, surgical	--	6
Respiratory therapist	1	2
Technician, dialysis	1	3
Technician, surgical	2	2
Technician/therapist, other than those listed above	--	9
Other healthcare occupations	--	4
Total	**56**	**138**

1. Healthcare workers are defined as those persons, including students and trainees, who have worked in a health care, clinical, or HIV laboratory setting at any time since 1978. See MMWR 1992;41:823-25.
2. Healthcare workers who had documented HIV seroconversion after occupational exposure or had other laboratory evidence of occupational infection: 48 had percutaneous exposure, 5 had mucocutaneous exposure, 2 had both percutaneous and mucocutaneous exposures, and 1 had an unknown route of exposure. Forty-nine healthcare workers were exposed to blood from an HIV-infected person, 1 to visibly bloody fluid, 3 to an unspecified fluid, and 3 to concentrated virus in a laboratory. Twenty-five of these healthcare workers developed AIDS.
3. These healthcare workers have been investigated and are without identifiable behavioral or transfusion risks; each reported percutaneous or muco-cutaneous occupational exposures to blood or body fluids, or laboratory solutions containing HIV, but HIV seroconversion specifically resulting from an occupational exposure was not documented.

Hepatitis B (HBV) infections have declined significantly due to widespread immunization of healthcare workers with the hepatitis B vaccine, the use of standard precautions and the OSHA Bloodborne Pathogens Standard. In 1983 17,000 new Hepatitis B infections were estimated among healthcare workers. In 1995, that number declined to 800, a 95% reduction in new cases of HBV. The CDC (1999) reports that since 1994, the number of Hepatitis B infections among healthcare workers has remained steady at approximately 800 annually.

After a single needlestick exposure to HBV infected blood or body fluid, the rate of HBV transmission to susceptible healthcare workers ranges from 6% to 30%. This applies only to those healthcare workers who are not immunized against HBV or who have not had prior infection. Those persons who have antibodies to HBV either from pre-exposure vaccination or prior infection are not at risk.

However, the CDC identifies that only a fraction of healthcare workers are exposed to HBV through percutaneous injuries. While needlesticks are among the most efficient modes of HBV transmission, these exposures probably account for only a minority of HBV infections among healthcare workers . In several investigations of nosocomial hepatitis B outbreaks, most infected healthcare workers could not recall an overt percutaneous injury, although in some studies, up to one third of infected healthcare workers recalled caring for a patient who was HBsAg-positive. In addition, HBV has been demonstrated to survive in dried blood at room temperature on environmental surfaces for at least 1 week. It is possible that HBV infections occurring in healthcare workers with no history of non occupational exposure or occupational percutaneous injury might have resulted from direct or indirect blood or body fluid exposures that inoculated HBV into cutaneous scratches, abrasions, burns, other lesions, or on mucosal surfaces (CDC, 2001).

The rate of infection in healthcare workers with Hepatitis C (HCV) after needlestick or other percutaneous injury averages 1.8% (Alter, 1997). Currently, no vaccine exists to prevent HCV infection. Preventing needlestick injury is the best approach to reducing the risk of infection with HCV. According to the CDC, HCV is not transmitted efficiently through occupational exposures to blood. The average incidence of anti-HCV seroconversion after accidental percutaneous exposure from an HCV-positive source is 1.8%, with one study indicating that transmission occurred only from hollow-bore needles compared with other sharps. Transmission rarely occurs from mucous membrane exposures to blood, and no transmission in healthcare providers has been documented from intact or nonintact skin exposures to blood. Data are limited on survival of HCV in the environment. In contrast to HBV, the epidemiologic data for HCV suggest that environmental contamination with blood containing HCV is not a significant risk for transmission in the healthcare setting, with the possible exception of the hemodialysis setting where HCV transmission related to environmental contamination and poor infection-control practices have been implicated (CDC, 2001).

Exposure to needlestick injury increases the risk of acquiring serious or fatal infections. More than 20 other infections, other than HIV, HVB, and HVC, can be transmitted through needlesticks, including: tuberculosis, syphilis, malaria and herpes (ANA, 1999). The ramifications of such an injury touch every aspect of a person's life, physically, emotionally, professionally, socially, and spiritually.

In addition to healthcare workers, patients in healthcare settings are also at significant risk for infection. In the United States, annually approximately 2 million patients acquire nosocomial infections, at a treatment cost exceeding $4.5 billion (Bures, et al, 2000).

In the US, the reporting of diseases is mandated by state laws and regulations. These laws and regulations, as to which infectious diseases are reportable, vary from state to state. The National Nosocomial Infections Surveillance (NNIS) System is a cooperative effort that began in 1970 between the Centers for Disease Control and Prevention (CDC) and participating hospitals to create a national nosocomial infections database. The database is used to:

- Describe the epidemiology of nosocomial infections
- Describe antimicrobial resistance trends
- Produce nosocomial infection rates to use for comparison purposes.

The data are collected uniformly by trained infection control personnel using surveillance protocols that target inpatients at high risk of infection and are reported routinely to CDC where they are aggregated into the database.

Participation in the NNIS System is voluntary and involves only acute care general hospitals in the United States. Long term care facilities, such as rehabilitation, mental health, and nursing homes are not included in the NNIS System. By law, CDC assures participating hospitals that any information that would permit identification of any individual or institution will be held in strict confidence.

Application of Controls to Reduce or Eliminate Hazards Related to Tuberculosis (TB)

The use of both engineering controls and work practice controls can help to reduce or eliminate the spread of TB. Engineering controls include the use of isolation rooms that provide 6 exchanges per hour. Portable ventilators should be used if appropriate rooms are not available. Negative pressure is needed; keep the patient room door closed. Verify air exchange rate and negative pressure regularly.

NIOSH approved HEPA filter respirators should be worn whenever:

- Entering rooms of patients with suspected or confirmed TB.
- Performing high hazard procedures in patients with suspected or confirmed TB, such as aerosolized medication administration, bronchoscopy, or sputum induction.
- Transporting patient with suspected or confirmed TB in a closed vehicle, even if the patient is wearing a mask.

The use of ultra violet light is an adjunct to other measures.

Work practice controls include the following:

- Awareness/triage
- Early isolation
- Close doors
- PPD surveillance every six months in high-risk areas, annually for others
- Patient/Family Education
- Consistent use of personal protective equipment

Element IV: Barriers and Personal Protective Equipment

The fourth element of the mandatory infection control training discusses selection and use of barriers and/or personal protective equipment for preventing patient and healthcare worker contact with potentially infectious material.

Definitions

Personal Protective Equipment (PPE): specialized clothing or equipment worn by a healthcare worker for protection against a hazard. OSHA requires the use of PPE to reduce employees' exposures to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures. Employers are required to determine all exposures to hazards in their workplace and determine if PPE should be used to protect healthcare workers

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

Types and Selection of PPE/Barriers

The choice of PPE is based on reasonably anticipated interaction and exposure between healthcare workers and patients. Federal and state laws and regulations, as well as agency policies and procedures provide guidance on the need for and selection of PPE.

Gloves are the most commonly used PPE. There are 3 main reasons for wearing gloves:

1. To reduce the potential that the healthcare worker will become infected with microorganisms from a host;

2. To reduce likelihood that personnel will transmit their own microorganisms to patients;

3. To reduce possibility that personnel will become colonized with microorganisms that can be transmitted to other patients.

Gloves are for single use only; they are disposable. **Gloves must be changed between patients;** hands are washed after removal of gloves.

There is a choice of sterile or non-sterile gloves; the decision is based on medical standards and the specific procedure to be performed. For procedures needing clean contact, non-sterile gloves are used. Routine patient care activities, including the care of patients with communicable diseases, non-surgical procedures to body systems, such as oral care, tube feeding, etc, are carried out with non-sterile gloves. For procedures needing surgical asepsis, or surgical technique, sterile gloves are used. These procedures include: surgical procedures, procedures involving sterile body cavities, procedures with susceptible hosts, preparation and administration of medications and fluids and procedures that require manual dexterity or precision on the part of the healthcare worker.

Some characteristics of gloves to consider in choosing the appropriate glove:

- Flexibility
- Dexterity
- Strength
- Use
- Durability

- Ease in application and removal
- Chemical resistance
- Imperviousness to blood and body fluid

Gloves are made from a variety of materials:

- Latex or natural rubber disposable gloves
    - **Note: Because of the recognized hazards and dangers to healthcare workers of repeated latex exposure and the increased cases of latex allergy, the use of latex products should be eliminated when possible. If latex gloves are used only powder free gloves should be used.**
- Non-latex disposable gloves
- Vinyl-synthetic polymer gloves
- Nitrite/rubber synthetic rubber utility gloves
- Polyethylene clear plastic film gloves such as those used in food handling
- Hypoallergenic gloves

If clothing is likely to come in contact with infective fluids, cover garb is used to prevent soiling of clothing when performing these patient care activities. Cover garb should only be worn once then either disposed or laundered.

Cover garb can be impervious or fluid resistant, permeable, disposable, or reusable. Types of cover garb include:

- Isolation/precaution gowns
- Surgical gowns
- Aprons
- Laboratory coats

Masks are used to prevent transmission of infectious agents through the air. They protect the wearer from inhaling large particle aerosols (droplets) or small particle aerosols (droplet nuclei). Types of masks include:

- Non-surgical masks, such as face shield
- Surgical, either gauze or disposable paper masks

HEPA filter particulate respirators are masks that must be properly fitted; they must be tight against the face, and the fit tested by qualified personnel and checked at regular intervals. These respirators are to be used by one individual, for as long as the fit is right and respirator is not contaminated. Make sure to write the date of use on the straps. Healthcare workers must be trained in the use of respirators initially and then an annual review must be provided. Ongoing monitoring of the use of respirators is needed.

Other PPE include: face shields, eye protection such as goggles or safety glasses, shoes and head covers, wound dressings, procedure drapes and plastic specimen/waste bags.

The choice of which PPE to use is based on a variety of factors, particularly the interaction between the healthcare worker and the patient:

- When coming in contact with blood or body fluid splash, utilize gloves, gown, face shield or mask and protective eyewear;
- When coming into contact with minimal bleeding or drainage, utilize gloves;
- If a large volume of bleeding or drainage will be contacted and likely to soak through contact area, utilize gloves and gown;
- In the case of respiratory droplets vs. airborne pathogens, utilize masks, face shield, eye protection, and HEPA filter if TB is suspected.

When choosing PPE based on the need for patient protection:

- If sterile barriers are needed for invasive procedures, utilize gowns, gloves, and dressings;
- For the prevention of droplet contamination, utilize a mask;
- In order to prevent drainage/lesions of the healthcare worker from contacting the patient, utilize dressings, gowns, and gloves.

Proper Application of Barriers/PPE for Protection

Again, agency policies and procedures will provide the healthcare worker with guidance. However, the following are generally guides:

- Availability and convenient location.
- Proper fit - gloves, masks, respirators.
- Integrity of barrier - quality control standards for imperviousness, impermeability, must change if integrity compromised.
- Disposable vs. reusable barriers/PPE - consider cost, ease of processing, integrity of barrier, medical waste regulations.
- There is potential for cross-contamination if not changed between patients. The individual professional is accountable and responsible for her or his own practices. Monitoring healthcare workers that one supervises for compliance with infection control policies and procedures is required.

Implications of over/under-utilization of barriers/PPE include cost, patient isolation, cross contamination and worker exposure.

Element V: Cleaning, Disinfection and Sterilization

The fifth element of this mandatory infection control course discusses 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 infection control principles and practices that are used to maintain a safe environment for patients must be tailored to the specific setting in which patients are treated. Hospitals have long been the site of much attention related to infection control, however, as healthcare has extended to multiple settings, outside of the hospital, it is clear that proper infection control must be applied to those settings as well. The reader is urged to consider the setting in which she or he is currently practicing and utilize the following information in relation to their particular clinical setting.

Definitions

Contamination – The presence of microorganisms on inanimate objects (clothing, surgical instruments) or in substances (water, food, milk).

Decontamination - The process of removing disease-producing microorganisms and rendering the object safe for handling. **Cleaning, disinfection, and sterilization** are all decontamination processes. These processes differ in the number and types of microorganisms killed. By knowing the differences between these processes, your will know how to choose the right way to reprocess reusable instruments and equipment.

> **Cleaning** - The removal of all foreign material (e.g., soil, organic debris, etc.) from objects, using water, detergents or soaps and washing or scrubbing the object (APIC, 1996).
>
> **Disinfection -** A process that results in the elimination of many or all pathogenic microorganisms on inanimate objects with the exception of bacterial endospores. This is accomplished with liquid chemicals or pasteurizing agents (APIC, 1996).
>
> - **High level disinfection –** Kills bacteria, mycobateris (TB), fungi, viruses and some bacterial spores.
> - **Intermediate level disinfection –** Kills bacteria, mycobacteria (TB), most fungi and most viruses. Does not kill resistant bacterial spores.
> - **Low-level disinfection –** Kills most bacteria, some fungi and some viruses. Will not kill bacterial spores and is less active against some gram-negative rods (pseudomonas) and mycobacteria.
>
> **Sterilization -** A process that completely eliminates or destroys all forms of microbial life. Sterilization is accomplished by the use of sterilizers under steam pressure, dry heat, ethylene oxide (ETO) and other gases, or through the use of liquid chemicals and a prolonged soaking time (APIC, 1996).

Potential for Contamination

The potential for contamination is dependent on the type of device, equipment or environmental surface.

Contamination occurs both internally and externally. Contact, or external, transmission is the most common route by which pathogens are transmitted in healthcare settings. Contact

transmission occurs most commonly when microorganisms from a patient are transferred to the hands of a healthcare worker who does not comply with infection control precautions, then touches another patient. Less commonly, environmental surfaces (e.g., bed rails, countertops) become contaminated and serve as an intermediate reservoir for pathogens; transmission can occur when a worker touches the surface then touches a patient or when a patient touches the surface.

Contamination can occur internally. For example, contaminated endoscopic equipment can transmit organisms internally to the patient. Proper infection control practices, regardless of the clinical setting (in-patient, clinic, etc.) must be followed in order to decrease the likelihood of infection. Since 1996, the FDA has required device manufacturers to recommend at least one reprocessing method on the product labeling (FDA, 1999a). It is critical that any automated endoscope reprocessor be used only with specific models of endoscopes that have been studied and validated to be effective by the manufacturer. Despite these FDA requirements, in New York State between 1996 and 1998, there were cases of serious infection secondary to inadequately reprocessed endoscopes (FDA, 1999a). This was a result of inconsistencies between the endoscope manufacturers' instructions regarding specific models and instructions provided by the manufacturers of automated endoscope reprocessors. Other infections resulted from faulty use of the reprocessors (FDA, 1999a).

Transmission by Contaminated Equipment

Transmission of disease to patients and healthcare workers may be associated with equipment or device contamination. The following are factors that have contributed to contamination in reported cases:

- Inadequate cleaning.
- Inadequate disinfection/sterilization processes.
- Contamination of disinfectant or rinse solutions.
- Reuse of disposable equipment.
- Failure to reprocess or dispose of equipment between patients.

Infection Control Issues in Reprocessing or Handling

The reuse/reprocessing of single-use items can be subject to breaks in infection control practices. The FDA has issued guidelines which allow reprocessing when a facility can establish that an item:

- Can be cleaned or sterilized adequately.
- Is not adversely affected by reprocessing.
- Remains safe and effective for its intended use.
- Have available written manufacturer's recommendations.

Whenever reprocessing of single use items is practiced, the facility must develop specific policies and procedures that address responsibilities.

The handling and cleaning of contaminated items is another point in which infection control practices can be compromised. OSHA guidelines for prevention of transmission of blood borne pathogens addresses the following:

1. Handling
    - Designated collection points and biohazard labels.
    - Transport in puncture resistant cleanable containers.
    - Processing area separate from sterile or clean supplies.
    - Designated area for cleaning, soaking, rinsing soiled items.
    - Contaminated items should not be placed directly on unprotected environmental surfaces.
    - PPE must be used.
2. Decontamination
    - Manual or mechanical cleaning is always the first step.
3. Pre-soaking
    - Use designated presoaking areas.
    - Do as soon as possible after use.
    - Presoak for specified, but minimal amount of time.
4. Cleaning - Items must be thoroughly cleaned before processing, because organic material (e.g., blood and proteins) may contain high concentrations of microorganisms. Also, such organic material may inactivate chemical germicides and protect microorganisms from the disinfection or sterilization process. - **Proper cleaning is the key!**
    - Clean items under running warm water to prevent aerosolization of microorganisms.
    - Clean items according to manufacturer's recommendations.
    - Clean items with nonabrasive implements.
    - Use brushes for items with lumens or holes.
    - Rinse thoroughly with running tap water or deionized/distilled water.
    - Dry items thoroughly prior to lubrication, disinfection, or sterilization.
    - Specific area should be designated for cleaning **- never** clean in patient area, hand washing sinks or clean or sterile areas.

Reprocessing methods include two levels:

- **Disinfection** - eliminates many or all pathogenic microorganisms with the exception of bacterial endospores.

- **Sterilization** - completely eliminates/destroys all forms of microbial life.

It is essential to always follow the manufacturer's recommendations. The level of reprocessing method must be based on the intended use of the item and risk of infection:

- **Critical** instruments/devices are those that are directly introduced into the human body, blood stream, or normally sterile areas of the body. These include items such as implants, scalpels, needles, other surgical instruments, dental instruments and endoscopic accessories. They require sterilization.

- **Semi-critical** instruments/devices are those that come in contact with mucous membranes or non-intact skin. These items include flexible endoscopes, laryngoscopes, endotracheal tubes, respiratory therapy and anesthesia equipment, diaphragm fitting rings and other similar devices. High-level disinfection is required. For instruments such as thermometers, oral or rectal, and smooth, hard surfaces such as hydrotherapy tanks, intermediate level disinfection is required.

- **Non-critical** instruments/devices are those that come in direct contact with the patient, but usually unbroken skin. These items include stethoscopes, tabletops, floors, bedpans, furniture, etc. They require low-level disinfection.

- **Environmental surfaces** have the least risk of disease transmission. They require routine cleaning.

The Disinfection Process

The selection and use of disinfectants for critical and non-critical items is dependent on level of antimicrobial activity needed:

- high level: glutaraldehyde, 3%-6% hydrogen peroxide, bleach

- intermediate level: alcohol, bleach, phenolics,

- low level: phenolics, iodophor, quaternary ammonium

Common Generic Chemical Disinfectants

Chemical Disinfectant	Required Concentration	Antimicrobial Activity
Glutaraldehyde based formulations	2%	High
Formaldehyde	1-8%	High-Low
H2O2	6%	High-Intermediate
Alcohol	70%	Intermediate
Iodophor	Variable	Intermediate-Low

In order for disinfectants to be used safely and effectively, they must be approved by the Environmental Protection Agency (EPA). Each healthcare organization must maintain a material safety data sheet (MSDS) on the agents involved. The MSDS provides information on the safe handling and use and storage of the agent. The label on the product must be read carefully, and manufacturer's recommendations must be followed exactly. Note expiration dates. Disinfectants should be used in well-ventilated areas, with no contact to the worker's skin or mucous membranes. Utilize PPE as indicated by the manufacturer; recommended strengths and times cannot be altered. Follow the manufacturers recommendations regarding post-disinfection storage and handling of the agent.

Once items have been disinfected, general guidelines are to rinse and dry items thoroughly; use sterile water to rinse objects that received high-level disinfection; dry with sterile towels or filtered

hot compressed air of 70 - 90% ethyl or isopropyl alcohol. Store in designated clean area where recontamination cannot occur. Store in closed cabinets, rigid washable covered containers, or tear-resistant bags.

The Sterilization Process

The selection and use of sterilization methods for critical items to render them sterile depends upon number of factors:

- Following manufacturer's written recommendations
- Using specified time required to achieve sterilization
- Cost
- Availability of equipment
- Processing area
- Trained personnel
- Compatibility of the sterilization method with the physical properties of the item

Methods of sterilization:

- Moist heat with steam under pressure (autoclave). High temperatures and pressure must be maintained over a period of time. Instrument must be cleaned, decontaminated, and packaged prior to autoclaving.
- Flash sterilization (270 - 275 degrees Fahrenheit for four minutes). Short duration, high temperature steam under pressure autoclaving for items that are not placed in any type of packaging or container. This form of rapid sterilization is used for single metal instruments, not wrapped.
- Ethylene oxide gas (ETO) for heat sensitive devices (plastic, rubber, scopes, etc.). Specific temperature and predetermined time are necessary.
- Glutaraldehyde - 2% alkaline and acid for items that are heat sensitive or can't tolerate gas. Review labels and use correctly; must rinse only with sterile water. Advantages: broad spectrum of antimicrobial activity, rapid inactivation of microorganisms, relative ease of use, lack of corrosive action against metals, rubbers, cements. Disadvantages: irritating odor, health effects from glutaraldehyde vapor.
- Unsaturated chemicals, sterilization beads, other chemicals and dry heat are additional sterilization methods that may be used depending on the item to be sterilized. Stabilized hydrogen peroxide (6%), peracetic acids.

A variety of methods exist to monitor the sterilization process.

In the steam sterilization process, monitoring includes:

- Mechanical indicators: recording charts for time and temperature, pressure gauges.
- Chemical/physical indicators: package strips, heat sensitive tapes, pellets.
- Biological indicators: biological monitors, spore strips.

In the ethylene oxide (ETO) sterilization process, monitoring includes:

- Mechanical indicators, recording graph, humidity gauge, gas, conditioner steam, pressure gauge.
- Chemical and physical indicators: heat sensitive tape, chemically treated paper strips.
- Biological indicators: spore strips.

In the glutaraldehyde sterilization process, monitoring includes:

- No specific biological monitoring.
- A visible expiration date.
- Visible organic debris indicates need to discard.
- Test kits are available.
- Dipstick monitors are available.
- Liquid chemical indicators change colors.

The process for post sterilization handling and storage must consider the selection of proper packaging material, shelf life and storage.

When selecting the proper packaging material, factors to consider include: size, shape, and weight of the item, allowance for penetration or evaporation of any chemicals. It is critical that the use of packing materials will maintain the sterility of the package contents. Appropriate packaging materials include: 180-240 thread count fabric, rigid sterilization containers, non-woven disposable materials.

Shelf life must be addressed in specific policies and procedures. Stored items must contain a specific expiration date on the package, or a statement that the contents are sterile until opened.

Storage of sterilized items should be in a clean, dry area. Sterile items should be handled as little as possible and not stored on the floor or within 18" of the ceiling. Rotate sterile items to move earlier expiring items to the front.

The following principles are applicable to most questions that the CDC receives about sterilization or disinfection of patient-care equipment. However, these statements are not comprehensive (CDC, 2000, www.cdc.gov/ncidod/hip/sterile/sterilgp.htm):

1. In general, reusable medical devices or patient-care equipment that enters normally sterile tissue or the vascular system or through which blood flows should be sterilized before each use. Sterilization means the use of a physical or chemical procedure to destroy all microbial life, including highly resistant bacterial endospores. The major sterilizing agents used in hospitals are a) moist heat by steam autoclaving, b) ethylene oxide gas, and c) dry heat. However, there are a variety of chemical germicides (sterilants) that have been used for purposes of reprocessing reusable heat-sensitive medical devices and appear to be effective when used appropriately, i.e., according to manufacturer's instructions. These chemicals are rarely used for sterilization, but appear to be effective for high-level disinfection of medical devices that come into contact with mucous membranes during use (e.g., flexible fiberoptic endoscopes).
2. Disinfection means the use of a chemical procedure that eliminates virtually all recognized pathogenic microorganisms but not necessarily all microbial forms (e.g., bacterial endospores) on inanimate objects. There are three levels of disinfection: high, intermediate, and low. High-level disinfection kills all organisms, except high levels of bacterial spores, and is effected with a chemical germicide cleared for marketing as a

sterilant by the Food and Drug Administration. Intermediate-level disinfection kills mycobacteria, most viruses, and bacteria with a chemical germicide registered as a "tuberculocide" by the Environmental Protection Agency (EPA). Low-level disinfection kills some viruses and bacteria with a chemical germicide registered as a hospital disinfectant by the EPA.

3. Heat stable reusable medical devices that enter the blood stream or enter normally sterile tissue should **always** be reprocessed using heat-based methods of sterilization (e.g., steam autoclave or dry heat oven).

4. Laparoscopic or arthroscopic telescopes (optic portions of the endoscopic set) should be subjected to a sterilization procedure before each use; if this is not feasible, they should receive high-level disinfection. Heat stable accessories to the endoscopic set (e.g., trocars, operative instruments) should be sterilized by heat-based methods (e.g., steam autoclave or dry heat oven).

5. Reusable devices or items that touch mucous membranes should, at a minimum, receive high-level disinfection between patients. These devices include reusable flexible endoscopes, endotracheal tubes, anesthesia breathing circuits, and respiratory therapy equipment.

6. Medical devices that require sterilization or disinfection must be thoroughly cleaned to reduce organic material or bioburden before being exposed to the germicide, and the germicide and the device manufacturer's instructions should be closely followed.

7. Except on rare and special instances (as mentioned below), items that do not ordinarily touch the patient or touch only intact skin are not involved in disease transmission, and generally do not necessitate disinfection between uses on different patients. These items include crutches, bedboards, blood pressure cuffs, and a variety of other medical accessories. Consequently, depending on the particular piece of equipment or item, washing with a detergent or using a low-level disinfectant may be sufficient when decontamination is needed. If noncritical items are grossly soiled with blood or other body fluids, follow instructions outlined in the section on HIV-related sterilization and disinfection of this information system.

Exceptional circumstances that require noncritical items to be either dedicated to one patient or patient cohort, or subjected to low-level disinfection between patient uses are those involving

1. Patients infected or colonized with vancomycin-resistant enterococci or other drug-resistant microorganisms judged by the infection control program, based on current state, regional, or national recommendations, to be of special or clinical or epidemiologic significance or

2. Patients infected with highly virulent microorganisms, e.g., viruses causing hemorrhagic fever (such as Ebola or Lassa).

If you have questions about a low or intermediate level disinfectant, contact the manufacturer, your local or state health department., or the Antimicrobial Program Branch, Registration Division, Environmental Protection Agency (EPA), (703) 305-7443. The EPA is the federal regulatory agency for low or intermediate level disinfectants.

If you have questions about high-level disinfectants (sterilants), or how to clean, disinfect or sterilize a particular medical device, first contact the manufacturer of the product. If you are unable to obtain sufficient information in this manner, contact the Food and Drug Administration (FDA) regional office or the FDA Center for Devices and Radiological Health at (301) 443-4690. FDA is the federal regulatory agency for safe and effective use of medical devices and is now also responsible for regulation of chemical sterilants

Environmental Cleaning

Routine cleaning and sanitizing of work surfaces is as important as care of medical devices and equipment. Bernard, et al. (2000) studied contaminated stethoscopes and found that gram-positive bacteria survived on stethoscope membranes for up to 18 hours. Bures, et al. (2000) studied sterile swab samples of computer keyboards and faucet handles. These authors concluded that the rate of colonization on these 2 surfaces is greater than that of other well-studied surfaces in intensive care units with patients positive for MRSA. Namias & Widrich (2000) studied personal pagers and found bacteria growing on 17 of 36 pagers, including *Staphylococcus aureus, Pseudomonas aeruginosa* and *Acinetobacteria* species.

With routine cleaning, the manufacturer's instructions should be followed, that is both the manufacturer of the item to be cleaned, and the manufacturer of the cleaning product. For disinfection, detergent formulations are effective. Schedules should be set for cleaning: after each patient, daily, weekly, monthly, etc.

- All surfaces that come in direct contact with blood/body fluid should be cleaned and sanitized between patient use.
- All surfaces that come in direct contact with patients should be cleaned and sanitized daily.

Recognizing Potential Sources of Cross-Contamination in the Healthcare Environment

Cleaning schedules are often set in facility policies and procedures. However, despite cleaning schedules and existing policies/procedures there are practices that contribute to touch contamination and the potential for cross contamination:

- Failure to wear gloves, wash hands, etc.
- Reuse of equipment.
- Failure to adequately clean/sanitize between patients.

It is important to select the right product for cleaning/sanitizing. The choice is dependent on the surface, use, and presence of blood/body fluids. Products used for disinfecting critical & semi-critical devices are not routinely used for external cleaning.

Blood Spills

Blood spills must be cleaned immediately. The first step is to contain the spill so that exposure to other individuals, equipment, or instruments is prevented until cleaned up.

Wear appropriate PPE; gloves are mandatory; gowns/aprons are used depending on extent of the spill. Wipe up the blood with a disposable cloth, pour a diluted bleach solution (1/4 cup household bleach to 1 gallon of water) or other EPA approved agent directly onto the surface, let this sit for 10 minutes, then wipe with a second disposable cloth.

Other OSHA-specific Environmental Issues

Medical waste is regulated by federal, state, and local agencies and includes specific regulations concerning regulated medical waste, proper handling and disposal of sharps. General guidelines are as follows:

Medical waste must be labeled as "Biohazard Waste" or Red Bagged. Included in medical waste are the following:

- Blood and blood products

- Human pathological waste
- Discarded vaccines
- Microbiological cultures
- Items that are blood soaked
- Sharps

Use labeled containers, licensed haulers, maintain tracking forms. PPE is to be utilized as necessary.

Soiled laundry is generally covered under facility policies, procedures and schedules. It is important to always utilize universal precautions in the handling of soiled laundry. Segregate soiled linens and PPE visibly soiled with blood or body fluids; utilize red bag or label biohazard or contaminated if universal precautions are not routinely used by outside laundry service.

Recognizing Differing Levels of Knowledge, Expectations and Responsibility Based on Area of Professional Practice

Healthcare professionals who practice in organizations where the responsibility for handling, cleaning, and reprocessing of equipment and devices is designated to another department may not need to know the detailed information about cleaning, disinfection and sterilization. However, the core concepts and principles described above have relevance. Healthcare professionals are responsible for the appropriate application of safe practices for handling devices and equipment in the area of professional practice and for the overall practices regarding infection control.

Knowledge Expectations of Individuals Who Have Primary or Supervisory Responsibilities for Equipment or Device Reprocessing

Those healthcare professionals who have primary or supervisory responsibilities for equipment or device reprocessing also must adhere to the core concepts and principles of cleaning, disinfection and sterilization described above. However, they also need to be knowledgeable about appropriate application of safe practices for handling devices and equipment specific to their particular clinical setting.

When selecting the appropriate method for reprocessing, those making the decisions should consider:

- The level of antimicrobial efficacy needed;
- The time constraints and requirements for various methods of reprocessing;
- The compatibility of the reprocessing method with the equipment or materials needing reprocessing, for example:
    - Corrosiveness
    - Penetrability
    - Heat tolerance
    - Moisture sensitivity

The toxicity of the reprocessing method must be considered as well. Any occupational health risks, environmental hazards, abatement methods, monitoring exposures if necessary, and any potential for patient toxicity must all be considered.

The residual effect of the reprocessing method must be considered. Antibacterial residual effect and patient toxicity are important considerations.

The ease of use of the reprocessing method must be taken into account, particularly any need for special equipment or special training requirements. Odor must be evaluated.

The stability of the method must be considered. This includes the concentration, potency, efficacy, and the effect of organic material.

Additionally, the ability to monitor the process is important; methods for monitoring the reprocessing and recommendations for the frequency of monitoring must be considered. FDA regulations regarding the reuse of single use devices, the recommendations of the manufacturer for reprocessing, as well as the manufacturer of the reprocessing methods or materials must all be taken into consideration by the person doing or supervising reprocessing.

Element VI: Infection Control Prevention in Healthcare Workers

This final element of the mandatory infection control course discusses the prevention and control of infectious and communicable diseases in healthcare workers.

Definitions

Communicable Disease - An illness due to a specific infectious agent which arises through transmission of that agent from an infected person, animal, or inanimate reservoir to a susceptible host.

Infectious Disease- A clinically manifest disease of human or animal resulting from an infection.

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

Overview of Occupational Health Activities

The goals of occupational health strategies are two-fold. The first goal is to prevent disease transmission by healthcare workers to patients. The second goal is to protect susceptible healthcare workers from infectious or communicable diseases.

Strategies used to assess healthcare workers for disease risks include pre-employment and periodic physical examinations/health assessments, immunizations and the evaluation of acute or incubating illnesses in the healthcare worker.

Hospitals as well as other healthcare organizations require pre-employment physical examinations and/or health assessments. Periodic physical examinations and health assessments occur after employment as well. Some of the information obtained in these assessments includes immunization history, childhood illnesses, PPD-TB status, skin conditions, and chronic diseases.

Immunization/screening programs to maintain immunity are another strategy for maintaining the health of healthcare workers and reducing the risk of transmission of possible illness to patients. Some of the diseases targeted for screening/immunization include: rubella, rubeola, varicella, hepatitis B, tuberculosis and influenza.

Proof of immunity is required for: rubella, rubeola, or certificate of immunization and pre employment PPD test with follow-up for positive results. Recommended immunizations are: hepatitis B, influenza, measles, mumps, and rubella. These regulatory requirements are required by OSHA/PESH and New York State, Title 10 Regulations.

The evaluation of acute or incubating illnesses in healthcare workers is dependent on the existence of signs and symptoms. Symptoms which should prompt evaluation for work fitness are:

- fever, chills
- cough, sputum production, other respiratory symptoms
- exanthema, vesicles
- skin lesions, weeping dermatitis
- draining wounds, sores
- diarrhea, nausea, vomiting

Post-exposure evaluation for incubating diseases in susceptible persons include:

- Tuberculosis - skin tests, chest x-rays if positive; prophylactic treatment.
- Varicella - remove from work 10th - 21st day after exposure or if exposure unrecognized until all lesions dried and crusted.
- Rubella - remove from work 7th - 21st day after exposure or for five days after onset of rash if exposure not known.
- Rubeola - offer measles vaccine within 3 days, immune globulin if within 6 days of exposure remove from workplace 5th - 21st day after exposure or 7 days after rash appears.
- Pertussis - surveillance and antibiotic for 14 days after exposure - remove healthcare worker with Pertussis for 3 weeks, or 5 days after the start of effective therapy.
- Mumps - remove from work 12th - 26th day after exposure or until 9 days after onset of parotitis

Strategies for interim management include:

- Limiting contact with susceptibles.
- Furlough until non-infectious.
- Evaluation/treatment as needed.

Diseases that must be reported to the Office of Health Systems Management and Bureau of Disease Control: rubella, rubeola, and pertussis.

Specific Prevention and Control Strategies

Healthcare workers are at risk for occupational exposure to bloodborne pathogens. As stated previously, in the United States, between 1985 and 2000, 56 “documented” cases and 138 “possible” cases of occupational HIV transmission cases were reported to the Centers for Disease Control and Prevention (CDC, 2000). The risk of transmission of HIV after needlestick injury is low, approximately 0.3%.

The rate of Hepatitis B virus transmission is high, approximately 6-30%, however the incidence has decreased 95% since 1993 due to widely available immunization against hepatitis B, the use of universal precautions and the OSHA bloodborne pathogen standard. In 1983 17,000 new Hepatitis B infections were estimated among healthcare workers. In 1995, that number declined to 800, and has remained at approximately 800 healthcare workers annually.

The vaccine against hepatitis B must be offered to healthcare workers at their place of employment. It is very effective and safe. It is now synthetic; the plasma derived product is no longer used in the US. The vaccine is encouraged for all healthcare workers involved in direct patient care or those exposed to blood/body fluids. Ideally, the vaccine (currently given in 3 doses over a 6 month period) should be completed during training **before** contact begins.

The risk of transmission of the Hepatitis C virus is approximately 3%. There is no currently available vaccine against hepatitis C. Viral incubation for HCV ranges from 5 to 7 weeks. Many people remain asymptomatic and diagnosis is often serendipitous.

Post Exposure Management for Bloodborne Pathogens

Two criteria are used in determining whether an occupational exposure has occurred:

- The body substance involved.
- The type of injury or contact. Examples of significant exposures which require medical management are: exposure to blood, semen, vaginal secretions and percutaneous exposure or permucosal exposure.

Categorizing exposures:

- **MASSIVE Exposure** - Transfusion of blood; large volume injection of blood: more than 1ml; parenteral exposure to lab materials containing high titer of virus.
- **DEFINITE Parenteral Exposure** - Intramuscular or deep injury with a blood or body fluid contaminated needle; injection of blood/body fluid; laceration or wound produced by a visibly bloody or body fluid contaminated instrument which causes bleeding in the healthcare worker; laceration of similar fresh wound inoculated with blood/body fluid instrument; any parenteral inoculation of HBV or HIV virus samples (usually in research settings) not included in Massive Exposure.
- **POSSIBLE Parenteral Exposure** - Subcutaneous or superficial injury with blood/body fluid; a wound produced by a blood/body fluid contaminated instrument; prior wound or skin lesion contaminated with blood or body fluid; mucous membrane inoculation with blood/body fluid.
- **DOUBTFUL Parenteral Exposure** - Subcutaneous or superficial injury with a needle or device contaminated with non-infectious/non-bloody fluids; a wound produced by a non-infectious body fluid contaminated instrument; prior wound or skin lesion contaminated with non-infectious body fluid; mucous membrane inoculation with non-infectious body fluid.
- **NON-PARENTERAL Exposure** - Intact skin visibly contaminated with blood/body fluid.

Evaluation of the Source

The person who is the source of the exposure should be informed and interviewed for information relevant to the exposure. It is advisable to seek permission for HIV antibody testing, as well as testing for Hepatitis B antibodies. HCV specific labs will include a HCV Polymerase chain reaction (PCR) to detect the presence or absence of virus, a HCV titer (HCV RNA) to determine the number of copies of virus present, and a genotype to identify the strain of virus with which the individual is infected

Management of Occupational Blood Exposures (MMWR, 2001):

- **Provide immediate care to the exposure site**
    - Wash wounds and skin with soap and water.
    - Flush mucous membranes with water.
- **Determine risk associated with exposure by**
    - Type of fluid (e.g., blood, visibly bloody fluid, other potentially infectious fluid or tissue, and concentrated virus) and

- Type of exposure (i.e., percutaneous injury, mucous membrane or nonintact skin exposure, and bites resulting in blood exposure).

- **Evaluate exposure source**
  - Assess the risk of infection using available information.
  - Test known sources for HBsAg, anti-HCV, and HIV antibody (consider using rapid testing).
  - Written permission must be obtained in order to disclose this information to exposed individual and his/her medical provider.
  - Confidentiality protection should be explained.
  - For unknown sources, assess risk of exposure to HBV, HCV, or HIV infection.
  - Do not test discarded needles or syringes for virus contamination.

- **Evaluate the Exposed Person**
  - Assess immune status for HBV infection (i.e., by history of hepatitis B vaccination and vaccine response).

- **Give post exposure prophylaxis (PEP) for exposures posing risk of infection transmission**
  - HBV: see appendix A
  - HCV: PEP not recommended.
  - HIV see appendix B
  - Initiate PEP as soon as possible, preferably within hours of exposure.
  - Offer pregnancy testing to all women of childbearing age not known to be pregnant.
  - Seek expert consultation if viral resistance is suspected.
  - Administer PEP for 4 weeks if tolerated.

Perform follow-up testing and provide counseling

- Advise exposed persons to seek medical evaluation for any acute illness occurring during follow-up.
- **HBV exposures**
  - Perform follow-up anti-HBs testing in persons who receive hepatitis B vaccine.
  - Test for anti-HBs 1--2 months after last dose of vaccine.
  - Anti-HBs response to vaccine cannot be ascertained if HBIG was received in the previous 3--4 months.

- **HCV exposures**

    - Perform baseline and follow-up testing for anti-HCV and alanine amino- transferase (ALT) 4--6 months after exposures.

    - Perform HCV RNA at 4--6 weeks if earlier diagnosis of HCV infection desired.

    - Confirm repeatedly reactive anti-HCV enzyme immunoassays (EIAs) with supplemental tests.

- **HIV exposures**

    Perform HIV-antibody testing for at least 6 months postexposure (e.g., at baseline, 6 weeks, 3 months, and 6 months).

    Perform HIV antibody testing if illness compatible with an acute retroviral syndrome occurs.

    Advise exposed persons to use precautions to prevent secondary transmission during the follow-up period.

    Evaluate exposed persons taking PEP within 72 hours after exposure and monitor for drug toxicity for at least 2 weeks.

Post-Exposure Management of Airborne or Droplet Pathogens

Nosocomial transmission of tuberculosis (TB) is well documented, but the transmission rate in the US is generally low. Transmission of TB in healthcare facilities has been primarily caused by incomplete implementation of recommended TB infection control measures (Boylard, et al., 1998). The CDC recommendations include:

- Strategies for prevention of transmission of TB

    These include a risk assessment, by reviewing a) the community TB profile, b) the number of patients with TB who were treated in each area of the facility, c) the drug susceptibility patterns of TB isolates from patients, d) an analysis of purified protein derivative (PPD) skin-test results of healthcare personnel by work area or occupational group, e) an evaluation of infection control parameters, including isolation policies, laboratory diagnostic capabilities and antituberculous therapy regimens, f) an observational review of TB infection control practices, and g) evaluation of the function and maintenance of environmental controls.

- TB screening program

    As previously mentioned, baseline PPD testing of all personnel should be done, including those with a history of bacilli Calmette-Guérin [BCG] vaccination during pre-employment physicals, or at application for hospital privileges. Those with positive PPD test reactions should obtain an initial chest radiograph.

- Follow-up evaluation

    The risk assessment will show which health care personnel have the potential for exposure to Mycobacterium tuberculosis and determine how frequently they should receive PPD testing. At a minimum, annual PPD testing is indicated for personnel with the potential for exposure to TB.

- Management of personnel after exposure to TB

  It is important to administer PPD tests to personnel as soon as possible after TB exposures are recognized. Such immediate PPD testing establishes a baseline with which subsequent PPD tests can be compared. A PPD test performed 12 weeks after the last exposure will indicate whether infection has occurred. Persons already known to have reactive PPD tests need not be retested. Personnel with evidence of new infection (i.e., PPD-test conversions) need to be evaluated for active TB. If active TB is not diagnosed, preventive therapy should be considered. For workers with positive PPD-test results who were probably exposed to drug-susceptible TB, preventive therapy with isoniazid is indicated, unless there are contraindications to such therapy.

  Personnel with active pulmonary or laryngeal TB pose a significant risk to patients and other personnel while they are infectious. Such workers must be excluded from work until adequate treatment is instituted, cough is resolved, and sputum specimens are negative on three consecutive AFB smears. Documentation of the above conditions must be provided to the Employee Health Service, or infection control personnel, before return to work.

  When a case of active tuberculosis in a person working in a healthcare facility is identified, the local health unit should be contacted to determine the appropriate management of the individual as well as workers and patients who may have been exposed. In addition, the Office of Health Systems Management, New York State Department of Health, should be notified of the incident (DOH, 1994).

Additionally, Boylard, et al., (1998) report that PPD testing is not contraindicated for persons who have received BCG vaccine and can be used to support or exclude the diagnosis of infection with *M. tuberculosis*. PPD test reactivity caused by BCG vaccination wanes with time and is unlikely to persist longer than 10 years after vaccination in the absence of infection with *M. tuberculosis*.

Post Exposure Management of Select Infectious Diseases

Varicella

The CDC Personnel Health Guidelines (Boylard, et al., 1998) recommendations include:

- Administer varicella vaccine to susceptible personnel, especially those that will have contact with patients at high risk for serious complications.
- Do not perform serologic screening of persons with negative or uncertain history of varicella before administering varicella vaccine to personnel, unless the institution considers it cost-effective.
- Do not routinely perform postvaccination testing of personnel for antibodies to varicella.
- No recommendation for administering postexposure varicella vaccination for the protection of exposed, susceptive personnel. This is an unresolved issue at the CDC.
- Develop guidelines for managing healthcare personnel who receive varicella vaccine; for example, consider precautions for personnel who acquire a rash after receipt of varicella vaccine and for other healthcare personnel who receive varicella vaccine and will have contact with susceptible persons at high risk for serious complications from varicella.
- Develop written guidelines for postexposure management of vaccinated or susceptible personnel who are exposed to wild-type varicella.
- Exclude personnel from work who have onset of varicella until all lesions have dried and crusted.
- Exclude from duty after exposure to varicella, personnel who are not known to be immune to varicella (by history or serology), beginning on the tenth day after the first exposure until the 21st day after the last exposure (28th day if VZIG was given).

- Restrict immunocompetent personnel with localized zoster from the care of high-risk patients until lesions are crusted; allow them to care for other patients with lesions covered.
- Restrict immunocompromised personnel with zoster from contact with patients until their lesions are crusted.
- Restrict susceptible personnel exposed to zoster from patient contact from the tenth day after the first exposure through the 21st day after the last exposure (28th day if VAIG was given).
- Perform serologic screening for immunity to varicella on exposed, vaccinated personnel whose antibody status is not known. If the initial test result is negative, retest 5 to 6 days after exposure to determine whether an immune response occurred.
- Consider excluding vaccinated personnel from work beginning on the 10th day after the first exposure through the 21st day after the last exposure if they do not have detectable antibodies to varicella, or screen daily for symptoms of varicella.
- Do not routinely give VZIG to exposed susceptible personnel, unless immunosuppressed, HIV infected, or pregnant. If VZIG is given, exclude personnel from duty from the 10th day after the first exposure through the 28th day after the last exposure.

Rubella

The CDC Personnel Health Guidelines (Boylard, et al., 1998) recommend the following:

- Vaccinate all personnel without documented immunity to rubella with rubella vaccine (MMR is the vaccine of choice, if the recipient is known to be immune to one or more of the components, monovalent or bivalent vaccines may be used).
- Consult local and state health departments regarding regulations for rubella immunity in health care personnel.
- Do not perform serologic screening for rubella before vaccinating personnel with rubella vaccine, unless the healthcare employer considers it cost-effective or the potential vaccine requests it.
- Do not administer rubella vaccine to susceptible personnel who are pregnant or might become pregnant within 3 months of vaccination.
- Administer rubella vaccine in the postpartum period to female personnel not known to be immune.
- Exclude susceptible personnel who are exposed to rubella from duty from the seventh day after the first exposure through the 21st day after the last exposure.
- Exclude personnel who acquire rubella from duty until 7 days after the beginning of the rash.

Measles

The CDC Personnel Health Guidelines (Boylard, et al., 1998):

- Ensure that all personnel have documented immunity to measles.

  Administer measles vaccine (MMR is the vaccine of choice. If the recipient is known to be immune to one or more of the components, monovalent or bivalent vaccines may be used) to persons born in 1957 or later, unless they have evidence of measles immunity.

  Administer measles vaccine to personnel born before 1957 if they do not have evidence of measles immunity and are at risk for occupational exposure to measles.

  Do not routinely perform serologic screening for measles before administering measles vaccine to personnel, unless the healthcare employer considers screening cost-effective or the potential vaccine requests it.

  Administer postexposure measles vaccine to measles-susceptible personnel who have contact with persons with measles within 72 hours after the exposure.

- Exclude exposed personnel who do not have documented immunity to measles from duty from the fifth day after the first exposure until the 21st day after the last exposure to measles, regardless of whether they receive postexposure vaccine.
- Exclude personnel who acquire measles from duty for 7 days after rash develops or for the duration of their acute illness, whichever is longer.

Pertussis

The CDC Personnel Health Guidelines (Boylard et al., 1998):

- Do not administer whole-cell pertussis vaccine to personnel.
- Immediately offer antimicrobial prophylaxis against pertussis to personnel who have had unprotected (i.e., Without the use of proper precautions), intensive (i.e., Close, face-to-face) contact with a patient who has a clinical syndrome highly suggestive of pertussis and whose cultures are pending; discontinue prophylaxis if results of cultures or other

tests are negative for pertussis and the clinical course is suggestive of an alternate diagnosis.
- o Exclude personnel in whom symptoms develop (e.g., cough ≥7 days, particularly if accompanied by paroxysms of coughing, inspiratory whoop, or posttussive vomiting) after known exposure to pertussis from patient care areas until 5 days after the start of appropriate therapy.

On June 10, 2005, a tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (Tdap), formulated for use in adults and adolescents, was licensed in the United States for persons aged 11–64 years (ADACEL®, manufactured by sanofi pasteur, Toronto, Ontario, Canada). Prelicensure studies demonstrated safety and efficacy, inferred through immunogenicity, against tetanus, diphtheria, and pertussis when Tdap was administered as a single booster dose to adults.

To reduce pertussis morbidity among adults and maintain the standard of care for tetanus and diphtheria prevention and to reduce the transmission of pertussis to infants and in healthcare settings, the Advisory Committee on Immunization Practices (ACIP) recommends that:

- adults aged 19–64 years should receive a single dose of Tdap to replace tetanus and diphtheria toxoids vaccine (Td) for booster immunization against tetanus, diphtheria, and pertussis if they received their last dose of Td >10 years earlier and they have not previously received Tdap;
- intervals shorter than 10 years since the last Td may be used for booster protection against pertussis;
- adults who have or who anticipate having close contact with an infant aged <12 months (e.g., parents, grandparents aged <65 years, child-care providers, and healthcare personnel) should receive a single dose of Tdap to reduce the risk for transmitting pertussis. An interval as short as 2 years from the last Td is suggested; shorter intervals can be used. When possible, women should receive Tdap before becoming pregnant. Women who have not previously received Tdap should receive a dose of Tdap in the immediate postpartum period;
- healthcare personnel who work in hospitals or ambulatory care settings and have direct patient contact should receive a single dose of Tdap as soon as feasible if they have not previously received Tdap. An interval as short as 2 years from the last dose of Td is recommended; shorter intervals may be used.

These recommendations for use of Tdap in healthcare personnel are supported by the Healthcare Infection Control Practices Advisory Committee (HICPAC). This statement 1) reviews pertussis, tetanus and diphtheria vaccination policy in the United States; 2) describes the clinical features and epidemiology of pertussis among adults; 3) summarizes the immunogenicity, efficacy, and safety data of Tdap; and 4) presents recommendations for the use of Tdap among adults aged 19–64 years.

(Source: www.cdc.gov, 2005)

Mumps

The CDC Personnel Health Guidelines (Boylard, et al, 1998):

- o Administer mumps vaccine to all personnel without documented evidence of mumps immunity, unless otherwise contraindicated (MMR is the vaccine of choice. If the recipient is known to be immune to one or more of the components, monovalent or bivalent vaccines may be used).
- o Before vaccinating personnel with mumps vaccine, do not routinely perform serologic screening for mumps, unless the healthcare employer considers screening cost-effective or it is requested by the potential vaccine.

- Exclude susceptible personnel who are exposed to mumps from duty from the 12th day after the first exposure through the 26th day after the last exposure, or if symptoms develop, until 9 days after the onset of parotitis.

Evaluation of Healthcare Workers Infected With HIV, HBV or Other Bloodborne Pathogens

On August 11, 1992 then Governor Cuomo signed legislation that formally codifies New York's policies and guidelines to protect all citizens from exposure to HIV, HBV, HCV and other bloodborne pathogens during medical/dental procedures and to safeguard the rights of infected workers. The New York State Department of Health then issued *Policy Statement and Guidelines to Prevent Transmission of HIV and Hepatitis B Through Medical/Dental Procedures.* The following is the Policy Statement:

> Based on evaluation of all available medical and scientific data, the Department of Health believes the following HIV and HBV-related policies best safeguard New York's citizens and protect the viability of our healthcare system:
>
> 1. The most effective means of preventing HIV and HBV transmission in healthcare settings is through strict adherence to universal barrier precautions and established infection control practices which decrease the opportunity of direct exposure to blood and body fluids for both workers and patients.
>
> 2. Voluntary testing without fear of disclosure or discrimination is the best means of encouraging people at risk for HIV or HBV to seek counseling and testing.
>
> 3. All patients and healthcare personnel who have been potentially exposed to HIV or HBV through personal risk behavior, blood products or occupational accidents should be strongly counseled to seek testing so they may benefit from medical management.
>
> 4. Mandatory HIV screening of New York healthcare workers would cost millions of dollars and would not produce any appreciable gain in public safety. A negative antibody test does not rule out the presence of infection since it can take some time for measurable antibodies to appear.
>
> 5. HIV or HBV infection alone does not justify limiting a healthcare worker's professional duties. Limitations, if any, should be determined on a case-by-case basis after consideration of the factors that influence transmission risk, including inability or unwillingness to comply with infection control standards or functional impairment which interferes with job performance.
>
> 6. Requiring healthcare workers to inform patients or employers that they are HIV or HBV positive would only serve as a deterrent to workers seeking voluntary testing and medical evaluation. It also would endanger the professional careers of competent and needed health personnel who pose no risk to patients.

The New York State Department of Health guidelines on HIV testing of healthcare workers include criteria for evaluating infected healthcare workers for risk of transmission.

1. Mandatory Infection Control Training for Healthcare Personnel i.e., this course.

2. Enforcement of Infection Control Standards (through legislation and regulations).

3. Protecting Healthcare Workers from Infection. Each healthcare facility should take the following steps to protect workers from occupational exposure to HIV, HBV, and other bloodborne pathogens.

- All healthcare workers should receive appropriate training for their job titles in infection control techniques, including engineering and work practice controls, universal precautions and work practices that help prevent needlesticks or other injuries and splashes of blood and body fluids.

- All healthcare personnel should be provided a safe work environment, including protective equipment, clothing and devices to reduce the risk of occupational exposure to blood and body fluids.

- All healthcare workers whose job responsibilities involve contact with blood or sharp objects likely to be contaminated with blood should be offered and encouraged to receive the hepatitis B vaccine.

- All healthcare personnel should receive information about the risks associated with HIV and HBV transmission and the merits of knowing their status if they have personal or occupational risks so they may benefit from medical management.

- All healthcare workers should be informed that if they have an impaired immune system due to HIV infection or other medical condition, they are at risk of acquiring potentially life-threatening infections, including TB, from patients.

- Information on the availability of voluntary, confidential or anonymous counseling and testing for HIV and HBV should be made available to healthcare workers.

4. Process for Evaluation of Infected Healthcare Workers

To ensure that public protection is a primary consideration and that healthcare personnel are afforded appropriate and equitable treatment, the Department of Health will establish a uniform process and criteria for evaluation of HIV/HBV-infected healthcare workers to determine if practice limitations are warranted.

Evaluation Criteria – The evaluation of a healthcare worker should be based on the premise that HIV or HBV infection alone is not sufficient justification to limit a healthcare worker's professional duties. The determination of whether an individual healthcare worker poses a significant risk to patients which warrants job modification, limitation or restriction requires a case-by-case evaluation which considers the multiple factors that can influence risk. Periodic re-evaluation of an HIV-infected healthcare worker may be appropriate if physical or mental functioning changes due to disease progression.

Factors that may have a bearing on the ability of healthcare workers, including those with bloodborne infections, to provide quality healthcare include:

- Physical or mental condition that may interfere with the worker's ability to perform assigned tasks or regular duties;

- Lack of compliance with established guidelines to prevent transmission of disease and/or documentation or evidence of previous transmission of bloodborne pathogens;

- The appropriateness of techniques as related to performance of procedures;

- Any health condition that would pose a significant risk to others.

Institutional Review Process – Under State Health Department regulations, all licensed healthcare institutions are responsible for ensuring that their employees, medical staff and volunteers do not have physical or mental impairment related to HIV or HBV infection

or any other condition that would interfere with the performance of their duties or pose a risk to patients.

Consistent with this regulation, healthcare facilities are responsible for establishing a mechanism for evaluating healthcare workers with HIV or HBV infection. This requirement should not be misconstrued to foster or condone involuntary screening of employees for HIV or HBV by healthcare institutions.

New York State law prohibits HIV testing of any citizen without written, informed consent. All healthcare workers should be counseled about the importance of learning their HIV and HBV status if they have been potentially infected through personal behavior or occupational exposure.

Institutional evaluations of individual workers known to be infected with HIV or HBV shall be based on the Department of Health criteria, and shall involve consultation with experts who can provide a balanced perspective. Such experts include an infectious disease physician and/or hospital epidemiologist with an understanding of HIV and HBV, a representative from the infected healthcare worker's practice area and the personal physician of the infected worker. All matters related to such evaluations must be handled confidentially.

Any modification of work practice must seek to impose the least restrictive alternative in accordance with federal disability laws. Any worker who believes that his/her employment has been restricted or terminated without just cause may ask for a second opinion from a Department of Health review Panel and/or file a complaint with the State Human Rights Commission.

State-Appointed Review Panels – The State Health department will establish and oversee a voluntary evaluation process to provide guidance to HIV/HBV-infected healthcare workers who seek consultation. Access to state-appointed panel review will be available to infected healthcare workers who perform procedures that might increase the risk of worker-to-patient blood exposure. State panels will function as a primary evaluation resource for practitioners who are not affiliated with institutions, or as a second opinion for workers affiliated with health facilities who have been evaluated by their institutions.

Each panel will include a public health official, an infectious disease expert, and an expert in infection control/epidemiology. In addition, an individual from the infected practitioner's area of practice and the individual's private physician may be asked to serve as members of the panel.

The purpose of such panels is to provide timely advice and consultation on an individual's risk of bloodborne disease transmission through his/her professional practice, and to recommend practice limitations, modifications or restrictions where the evidence suggests there is a significant risk to patients.

The evaluation process will be confidential except for the following circumstances:

- To adequately evaluate workers who are institutionally based, the panel – directly or through its designees – may need to request information about the worker's practice from the facility.

- If practice restrictions are recommended, the individual involved shall assure – and verify to the panel – that all health facilities where he/she practices are informed. If assurance is not forthcoming, the panel will inform such facilities. Within all facilities, the normal rules of confidentiality apply.

DOH Consultation – Staff of the Department of Health will be available to any individual, institution or organization to discuss concerns, about the management of employees with HIV or HBV. In addition, the department will provide information, confidentially or anonymously, on the process for accessing the state review panels described above.

Enforcement of Practice Restrictions – Healthcare institutions will be responsible for ensuring that any practice limitations recommended by institutional panels are followed in the facility by healthcare workers who are in their employ or who provide patient care from their facilities. If practice limitations are recommended for a community-based physician or dentist, periodic monitoring to ensure compliance will be performed by the State Department of Health or Education with the professional's consent. If a healthcare professional does not follow the practice restrictions or if compliance is uncertain, the appropriate state licensing/certification/permit board will be notified. The professional may be charged with professional misconduct for negligent practice in violation of the State Education Law.

Confidentiality of a Healthcare Worker's HIV Status – HIV-infected healthcare workers are entitled to protections under the New York State HIV confidentiality Law as are all citizens. Such workers are not required to disclose their HIV status to patients or employers. Healthcare facilities are under no obligation under New York law to disclose to patients the status of an infected healthcare worker in their employ; such disclosure, without the consent of the worker, would likely violate New York's HIV Confidentiality Law.

Notification of patients that they were exposed to the blood of a healthcare worker should be based on documentation of an injury to a worker that could have resulted in the worker's blood coming into direct contact with a patient's bloodstream or mucous membranes. In such circumstances, the patient should be advised to receive testing for potential HIV or HBV exposure. The Department of Health will be available to assist hospitals in determining if a significant risk of exposure to bloodborne pathogens warrants notification to patients.

5. Quality Assurance Protections

   Hospital quality assurance programs and, under their umbrella, infection control policies and procedures are key mechanisms for preventing disease transmission within healthcare settings. To further reduce the low risk of HIV or HBV transmission through medical procedures, hospitals should take the following actions:

   - Assure that infection control policies and procedures for the prevention of bloodborne infections are in place and being monitored for compliance.
   - Review existing policies and procedures to assure that mechanisms are in place for reporting and managing circumstances where an employee is exposed to a patient's blood or there has been mutual blood exposure between a patient and employee (i.e., during a procedure where injury to a worker resulted in both parties having contact with the other person's blood).
   - Form cooperative work groups to review surgical techniques to identify changes in practice or other alternatives to reduce any risk of potential injury to a healthcare worker that could result in blood exposure to patients.

   Source: NYSDOH Policy Statement and Guidelines to Prevent Transmission of HIV and Through Medical/Dental Procedures. August, 1992 - FINAL

Considerations while applying and implementing the policies and guidelines above include:

- Nature and scope of professional practice
    1. Techniques used in performance of invasive procedures that may pose a risk to patients.
    2. Compliance with infection control standards.
- Presence of weeping dermatitis or skin lesions.
- Overall health status
    1. Physical health
    2. Cognitive function

Conclusion

Healthcare professionals have long known the benefits of practicing utilizing good infection control principles. However, in addition to their professional and ethical responsibilities to follow good infection control practices, New York State mandates this course so that professionals will also understand their legal responsibilities, since an incident utilizing poor infection control principles can render one open to charges of professional misconduct. This applies to the professional, her or himself, but also to those for whom the professional is responsible.

The six elements of this mandated course for select healthcare professionals addressed:

- The responsibility to adhere to accepted principles and practices of infection control for the healthcare professional and the performance of those for whom the professional is responsible;
- The modes and mechanisms of transmission of pathogenic organisms in the healthcare setting and strategies for prevention and control;
- The use of engineering and work practices to reduce the opportunity for patient and healthcare worker exposure to potentially infectious material;
- The selection and use of personal protective equipment for preventing patient and healthcare worker contact with potentially infectious material;
- The creation and maintenance of a safe environment for patient care through the application of infection control principles and practices for cleaning, disinfection and sterilization; and
- The prevention and control of infectious and communicable diseases in the healthcare worker.

Appendix A

Post Exposure Prophylaxis for HBV

I. Recommended postexposure prophylaxis for exposure to hepatitis B virus

Vaccination and antibody response status of exposed workers*	Treatment		
	Source HBsAg† positive	Source HBsAg† negative	Source unknown or not available for testing
Unvaccinated	HBIG§ x 1 and initiate HB vaccine series¶	Initiate HB vaccine series	Initiate HB vaccine series
Previously vaccinated			
Known responder**	No treatment	No treatment	No treatment
Known nonresponder††	HBIG x 1 and initiate revaccination or HBIG x 2§§	No treatment	If known high risk source, treat as if source were HBsAg positive
Antibody response unknown	Test exposed person for anti-HBs¶ 1. If adequate,** no treatment is necessary 2. If inadequate,†† administer HBIG x 1 and vaccine booster	No treatment	Test exposed person for anti-HBs 1. If adequate,¶ no treatment is necessary 2. If inadequate,¶ administer vaccine booster and recheck titer in 1–2 months

* Persons who have previously been infected with HBV are immune to reinfection and do not require postexposure prophylaxis.

† Hepatitis B surface antigen.

§ Hepatitis B immune globulin; dose is 0.06 mL/kg intramuscularly.

¶ Hepatitis B vaccine.

** A responder is a person with adequate levels of serum antibody to HBsAg (i.e., anti-HBs ≥10 mIU/mL).

†† A nonresponder is a person with inadequate response to vaccination (i.e., serum anti-HBs < 10 mIU/mL).

§§ The option of giving one dose of HBIG and reinitiating the vaccine series is preferred for nonresponders who have not completed a second 3-dose vaccine series. For persons who previously completed a second vaccine series but failed to respond, two doses of HBIG are preferred.

¶¶ Antibody to HBsAg.

Appendix B

Basic, Alternate and Expanded HIV Post Exposure Prophylaxis (PEP) Regimens (*MMRW*, 2001):

Basic PEP Regimen

- **Zidovudine (RETROVIR™; ZDV; AZT) + Lamivudine (EPIVIR™; 3TC); available as COMBIVIR™**
    - ZDV: 600 mg per day, in two or three divided doses, and
    - 3TC: 150 mg twice daily.

Advantages

- ZDV is associated with decreased risk of HIV transmission in the CDC case-control study of occupational HIV infection.
- ZDV has been used more than the other drugs for PEP in Health Care Provider (HCP).
- Serious toxicity is rare when used for PEP.
- Side effects are predictable and manageable with antimotility and antiemetic agents.
- Probably a safe regimen for pregnant HCP.
- Can be given as a single tablet (COMBIVIR™) twice daily.

Disadvantages

- Side effects are common and might result in low adherence.
- Source patient virus might have resistance to this regimen.
- Potential for delayed toxicity (oncogenic/teratogenic) is unknown.

Alternate Basic PEP Regimen

- **Lamivudine (3TC) + Stavudine (ZERIT™; d4T)**
    - 3TC: 150 mg twice daily, and
    - d4T: 40 mg (if body weight is <60 kg, 30 mg twice daily) twice daily.

Advantages

- well tolerated in patients with HIV infection, resulting in good adherence
- serious toxicity appears to be rare, and
- twice daily dosing might improve adherence

Disadvantages

- Source patient virus might be resistant to this regimen.

- Potential for delayed toxicity (oncogenic/teratogenic) is unknown.

- **Didanosine (VIDEX™, chewable/dispersible buffered tablet; VIDEX™ EC, delayed-release capsule; ddI) + Stavudine (d4T)**

  - ddI: 400 mg (if body weight is <60 kg, 125 mg twice daily) daily, on an empty stomach.

  - d4T: 40 mg (if body weight is <60 kg, 30 mg twice daily) twice daily.

  Advantages

  - Likely to be effective against HIV strains from source patients who are taking ZDV and 3TC.

  Disadvantages

  - ddI is difficult to administer and unpalatable.

  - Chewable/dispersible buffered tablet formulation of ddI interferes with absorption of some drugs (e.g., quinolone antibiotics, and indinavir).

  - Serious toxicity (e.g., neuropathy, pancreatitis, or hepatitis) can occur. Fatal and nonfatal pancreatitis has occurred in HIV-positive, treatment-naive patients. Patients taking ddI and d4T should be carefully assessed and closely monitored for pancreatitis, lactic acidosis, and hepatitis.

  - Side effects are common; anticipate diarrhea and low adherence.

  - Potential for delayed toxicity (oncogenic/teratogenic) is unknown.

Expanded PEP Regimen

Utilize basic PEP regimen plus one of the following:

- **Indinavir (CRIXIVAN™; IDV)**

  - 800 mg every 8 hours, on an empty stomach.

  Advantages

  - Potent HIV inhibitor.

  Disadvantages

  - Serious toxicity (e.g., nephrolithiasis) can occur; must take 8 glasses of fluid per day.

  - Hyperbilirubinemia common; must avoid this drug during late pregnancy.

  - Requires acid for absorption and cannot be taken simultaneously with ddI in chewable/dispersible buffered tablet formulation (doses must be separated by at least 1 hour).

  - Concomitant use of astemizole, terfenadine, dihydroergotamine, ergotamine, ergonovine, methylergonovine, rifampin, cisapride, St. John's Wort, lovastatin, simvastatin, pimozide, midazolam, or triazolam is not recommended.

- Potential for delayed toxicity (oncogenic/teratogenic) is unknown.

- **Nelfinavir (VIRACEPT™; NFV)**
  - 750 mg three times daily, with meals or snack, or
  - 1250 mg twice daily, with meals or snack.

  Advantages

  - potent HIV inhibitor, and
  - twice dosing per day might improve adherence.

  Disadvantages

  - Concomitant use of astemizole, terfenadine, dihydroergotamine, ergotamine, ergonovine, methylergonovine, rifampin, cisapride, St. John's Wort, lovastatin, simvastatin, pimozide, midazolam, or triazolam is not recommended.
  - Might accelerate the clearance of certain drugs, including oral contraceptives (requiring alternative or additional contraceptive measures for women taking these drugs).
  - Potential for delayed toxicity (oncogenic/teratogenic) is unknown.

- **Efavirenz (SUSTIVA™; EFV)**
  - 600 mg daily, at bedtime.

  Advantages

  - Does not require phosphorylation before activation and might be active earlier than other antiretroviral agents (note: this might be only a theoretical advantage of no clinical benefit.)
  - One dose daily might improve adherence.

  Disadvantages

  - Drug is associated with rash (early onset) that can be severe and might rarely progress to Stevens-Johnson syndrome.
  - Differentiating between early drug-associated rash and acute seroconversion can be difficult and cause extraordinary concern for the exposed person.
  - Nervous system side effects (e.g., dizziness, somnolence, insomnia, and/or abnormal dreaming) are common. Severe psychiatric symptoms are possible (dosing before bedtime might minimize these side effects).
  - Should not be used during pregnancy because of concerns about teratogenicity.
  - Concomitant use of astemizole, cisapride, midazolam, triazolam, ergot derivatives, or St. John's Wort is not recommended because inhibition of the metabolism of these drugs could create the potential for serious

and/or life-threatening adverse events (e.g., cardiac arrhythmias, prolonged sedation, or respiratory depression).

- Potential for oncogenic toxicity is unknown.

- **Abacavir (ZIAGEN™; ABC); available as TRIZIVIR™, a combination of ZDV, 3TC, and ABC**

  - 300 mg twice daily.

  Advantages

  - potent HIV inhibitor, and
  - well tolerated in patients with HIV infection.

  Disadvantages

  - Severe hypersensitivity reactions can occur, usually within the first 6 weeks of treatment.
  - Potential for delayed toxicity (oncogenic/teratogenic) is unknown.

Antiretroviral Agents for Use as PEP Only With Expert Consultation

- **Ritonavir (NORVIR™; RTV)**

  Disadvantages

  - difficult to take (requires dose escalation),
  - poor tolerability, and
  - many drug interactions.

- **Saquinavir (FORTOVASE™, soft-gel formulation; SQV)**

  Disadvantages

  - Bioavailability is relatively poor, even with new formulation.

- **Amprenavir (AGENERASE™; AMP)**

  Disadvantages

  - Dosage consists of eight large pills taken twice daily.
  - Many drug interactions.

- **Delavirdine (RESCRIPTOR™; DLV)**

  Disadvantages

  - Drug is associated with rash (early onset) that can be severe and progress to Stevens-Johnson syndrome.
  - Many drug interactions.

- **Lopinavir/Ritonavir (KALETRA™)**

- 400/100 mg twice daily.

Advantages

- potent HIV inhibitor, and
- well tolerated in patients with HIV infection.

Disadvantages

- Concomitant use of flecainide, propafenone, astemizole, terfenadine, dihydroergotamine, ergotamine, ergonovine, methylergonovine, rifampin, cisapride, St. John's Wort, lovastatin, simvastatin, pimozide, midazolam, or triazolam is not recommended because inhibition of the metabolism of these drugs could create the potential for serious and/or life-threatening adverse events (e.g., cardiac arrhythmias, prolonged sedation, or respiratory depression).
- May accelerate the clearance of certain drugs, including oral contraceptives (requiring alternative or additional contraceptive measures for women taking these drugs).
- Potential for delayed toxicity (oncogenic/teratogenic) is unknown.

Antiretroviral Agents Generally Not Recommended For Use as PEP

- **Nevirapine (VIRAMUNE™; NVP)**
  - 200 mg daily for 2 weeks, then 200 mg twice daily.

Disadvantages

- Associated with severe hepatotoxicity (including at least one case of liver failure requiring liver transplantation in an exposed person taking PEP)
- Associated with rash (early onset) that can be severe and progress to Stevens-Johnson syndrome
- Differentiating between early drug-associated rash and acute seroconversion can be difficult and cause extraordinary concern for the exposed person, and
- Concomitant use of St. John's Wort is not recommended because this might result in suboptimal antiretroviral drug concentrations.

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New York State Mandated Infection Control and Barrier Precautions

Course Exam

*NOTE: After studying the downloaded course and completing the exam, you need to enter your exam answers ONLINE; answers cannot be answered and graded on this downloadable version of the course. To enter your answers return to e-leaRN's Web site, **www.elearnonline.net** and click on the Login/My Account button. Next, login using your username and password, follow the prompts to access the course material, and proceed to the course exam.

1. In addition to mandating that certain health professionals receive training on infection control and barrier precautions, New York State has established that

   a. failure to report a case of human immunodeficiency virus (HIV) infection is considered unprofessional conduct.
   b. failure to utilize infection control procedures is considered unprofessional conduct.
   c. sterilization is required for all patient care materials.
   d. high-level disinfection is required for all patient care materials.

2. According to the Needlestick Safety and Prevention Act of 2000, employers are required to

   a. conduct research on the effectiveness of safety devices.
   b. notify the Occupational Safety and Health Administration (OSHA) when they purchase new safety devices.
   c. maintain a log of sharps injuries.
   d. provide care to family members of employees who have sustained sharps injuries.

3. According to New York State law, the professional conduct standards require that certain healthcare professionals may be subject to charges of unprofessional conduct for failure to

   a. insure that others carry out infection control standards.
   b. undergo testing for the human immunodeficiency virus (HIV) if a needlestick occurs.
   c. serve on a professional review panel regarding infection control standards, if asked.
   d. wear gown, gloves, and mask when caring for patients who are infected with HIV.

4. Which of the following organizations provide scientifically sound infection control recommendations?

   a. National Institute for Occupational Safety and Health (NIOSH).
   b. National Council of State Boards of Nursing (NCSBN).
   c. American Nurses Association (ANA).
   d. Joint Commission on Accreditation of Healthcare Organizations (JCAHO)

5. A factor that causes a person to become a susceptible host to a specific organism is the person's

   a. nutritional status.
   b. role in the family.
   c. marital status.
   d. birth order.

6. An organism described as “highly virulent” has which of these characteristics?

   a. The organism is easily destroyed by high-level disinfectants.
   b. Exposure to a small amount of organism can cause infection.
   c. The organism is resistant to many antibiotics.
   d. Culture and sensitivity must be performed to identify the organism.

7. The ***most*** common effective way to prevent nosocomial infections is to use

   a. sterile technique.
   b. complete isolation.
   c. disinfection.
   d. hand hygiene.

8. Which of the following isolation systems is used in all healthcare facilities?

   a. Category specific isolation.
   b. Body substance isolation.
   c. Standard precautions.
   d. Disease specific precautions.

9. Which of the following is a **work practice control** that should be implemented to protect patients and healthcare workers?

   a. Implementing an air exchange ventilation system..
   b. Selecting puncture resistant needle containers.
   c. Not recapping needles.
   d. Using centrifuge lids that lock.

10. Which of the following is an **engineering control** that would assist in preventing the transmission of tuberculosis?

    a. PPD testing and follow-up.
    b. Triage and separation of infected patients.
    c. Early identification of patients with tuberculosis.
    d. A negative pressure room.

11. Non-sterile gloves may be used for which of these procedures?

    a. Gastric tube feedings.
    b. Minor surgery.
    c. Bladder catheterization.
    d. Suturing wounds.

12. Which of the personal protective equipment (PPE) listed below should be used when changing a dressing for a patient who has a three-day-old clean surgical incision?

    a. Gloves, only.
    b. Gloves and gown, only.
    c. Gloves, gown, and mask, only.
    d. Gloves, gown, mask, and goggles.

13. A healthcare worker is planning to provide care to a patient who has active tuberculosis. The worker should plan to wear

    a. a surgical mask.
    b. a HEPA filter respirator.
    c. sterile gloves.
    d. a gown.

14. Which of the following practices would result in contamination?

    a. Sterilizing instruments for a length of time that exceeds the time recommended.
    b. Using a disinfectant that is clear and colorless.
    c. Rinsing disinfected items with sterile water.
    d. Reusing single-use equipment without reprocessing.

15. To insure proper processing of items and equipment for patient care, it is ***essential*** to use

    a. a central sterilization department.
    b. the manufacturer's recommendations.
    c. single-use items for all sterile procedures
    d. Federal Drug Administration (FDA) guidelines.

16. Which of the following would be considered an **occupational health goal** for preventing infection in a healthcare setting?

    a. Providing healthcare workers with paid sick leave.
    b. Preventing healthcare workers from caring for patients who have undiagnosed illnesses.
    c. Protecting healthcare workers from communicable diseases.
    d. Insuring that the meals provided for healthcare workers are well-balanced.

17. Which of the following organisms that healthcare workers may encounter in their work can remain viable on environmental surfaces for approximately one week?

    a. Hepatitis C virus (HCV).
    b. Human immunodeficiency virus (HIV).
    c. Mycobacterium tuberculosis (TB).
    d. Hepatitis B virus (HBV).

18. A healthcare worker is observed cleaning instruments prior to sterilization. Which of these actions of the worker represents an error that requires correction?

    a. The worker cleans the instruments in a handwashing sink.
    b. The instruments are cleaned under running warm water.
    c. Brushes are used to clean instruments with lumens.
    d. The worker rinses the instruments with distilled water.

19. A healthcare employee in a community hospital is found to be infected with the human immunodeficiency virus (HIV). According to New York State law, the hospital's evaluation of the employee's ability to continue working must include consultation with experts including an infectious disease specialist, a representative from the employee's practice area, and

    a. the state-appointed review panel.
    b. the employee's personal physician.
    c. a physician approved by the Occupational Safety and Health Administration (OSHA).
    d. a physician provided through the Centers for Disease Control and Prevention (CDC).

20. A healthcare worker who is HIV-positive expresses concern about confidentiality related to the condition. Which of the following statements provide accurate information about the healthcare worker's right to confidentiality?

    a. With the exception of physicians and dentists, the confidentiality of healthcare workers is protected by the New York State law.
    b. The confidentiality of a healthcare worker is protected under New York State law provided that the worker's activities do not include direct patient care.
    c. The worker is protected by the New York State HIV confidentiality law and is not required to disclose HIV status to patients or employers.
    d. The worker's employer is required under New York State law to disclose to patients the status of the infected healthcare worker if the worker performs invasive procedures.