NYS Approved Infection Control Course
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Element I
The Responsibility to Adhere to Scientifically Accepted Principles and Practices of Infection Control and to Monitor Those For Whom the Profession is Responsible

Learning Objectives
At the conclusion of course work on this element, the learner will be able to:

- Recognize the benefit to the **patients and healthcare workers** of adhering to scientifically accepted principles and practices of infection control.
- Recognize the professional's responsibility to adhere to scientifically accepted infection control practices and the consequences of failing to comply.
- Recognize the professional's responsibility to monitor infection control practices of those for whom he/she is responsible and to intervene as necessary for compliance and safety.

For many years, regulated healthcare settings such as hospitals and nursing homes have been required to put infection control policies and procedures in place to protect patients, healthcare workers and visitors. It was concern over the immunodeficiency (HIV) and hepatitis B viruses that expanded these regulations to all healthcare settings. In 1987, the Centers for Disease Control and Prevention (CDC) defined and disseminated the concept of "universal precautions" to prevent the transmission of these viruses and other bloodborne pathogens during the provision of healthcare. It soon became apparent that the best strategy for protecting the public in all healthcare settings is assuring that infection control procedures are in place and routinely observed. These practices must protect patients from cross contamination from other patients, but must also protect healthcare workers and patients from exposure to pathogens during the direct delivery of services. While HIV and HBV were "driving" policy and ultimately legislation, other pathogens also pose risk of infection, and the principles of infection control will diminish risk for exposure to all infectious agents.

The responsibility to adhere to scientifically accepted principles and practices of infection control is a legal, professional and ethical requirement. There are federal as well as New York State regulations that govern this responsibility, as well as standards of professional practice.

Failing to follow accepted standards of infection control increases the risk of adverse health outcomes for patients and healthcare workers. In addition, a complaint of

professional misconduct can be made to the licensing board of the New York State Education Department, regardless of impact on patient care and health outcomes.

The general provisions for health professionals include this definition of unprofessional conduct: "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." This standard is applicable not only to the healthcare professional, but also to healthcare workers under his/her supervision. Professionals supervising healthcare workers who fail to practice appropriate infection control techniques may also be subjected to charges of unprofessional conduct.

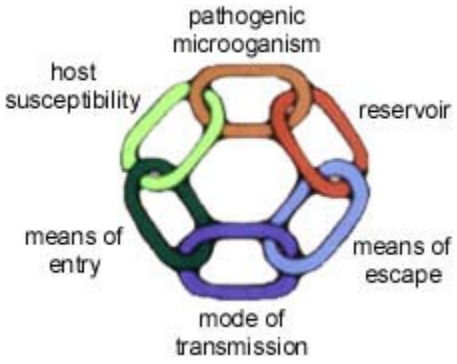
All complaints must be investigated, and if the charge of unprofessional conduct is substantiated, the professional may be subjected to disciplinary action, revocation of the professional license, and/or legal action for liability.

In New York State, the Education Law was amended in 1992 by adding a section requiring the completion of course work or training "appropriate to the professional's practice and approved by the department regarding infection control and barrier precautions, including engineering and work practice controls….which will be consistent with such standards adopted by the department of health."

Element II
Modes and Mechanisms of Transmission of Pathogenic Organisms in the Healthcare Setting and Strategies for Prevention and Control

Learning Objectives
At the conclusion of course work on this element, the learner will be able to:

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



THE CHAIN OF INFECTION

The concept of "The Chain of Infection" includes six elements, or links in the chain that are required for an infection to occur. Infection control involves breaking the chain at any point in order to prevent the occurrence of disease.

1. Pathogen: An infectious agent, or pathogen, is required for an infection. Bacteria, viruses, fungi, and parasites are all pathogens. Some common pathogens are:
    - Bacteria—E. coli, pseudomonas, Mycobacterium tuberculosis
    - Viruses—Hepatitis B (HBV), Human immunodeficiency virus (HIV), herpes zoster
    - Fungi—candida
    - Parasites—tapeworm
2. Reservoir and sources: All pathogens have a reservoir and a source. Reservoirs are places where organisms live and grow and sources are places from which the pathogen passes to the host via a vehicle of transmission. The reservoir and the source for a particular infectious agent may be the same or different. They may be animate or inanimate objects. For example, the tear film may be a reservoir for a bacterial pathogen, and a contaminated tonometer tip or eyedropper may be the source. Reservoirs can occur in an acute or carrier state. The acute state is

associated with clinical symptoms of the disease. A carrier may be infected with the infectious agent that can be transmitted to a susceptible host, but is unaware of this because of a lack of symptoms. An example of this is infection with HIV and the subsequent development of AIDS. Different infectious agents have different reservoirs, and public health efforts to reduce the incidence of infectious disease often focus on managing/eliminating reservoirs.

3. Portals of exit: vehicles and mechanisms by which pathogens leave the body. Portals of exit include:
    - Drainage of blood and other body substances
    - Coughing, sneezing, respiratory/oral secretions
    - Draining lesions
    - Diarrhea
4. Means of transmission: any mechanism by which the pathogen is transmitted from a reservoir or source to a susceptible host. There are 5 routes of transmission.
    a. Contact transmission is the most important and most frequent mode of transmission of nosocomial infections (an infection that was not present prior to admittance to a hospital or other healthcare setting). Nosocomial infections typically occur within 72 hours of hospital interaction. In the US, approximately 2 million patients acquire nosocomial infections annually, at a cost of $4.5 billion.
        i. Direct contact involves person-to-person contact and the physical transfer of the pathogen, such as shaking hands, inverting an eyelid or bathing a patient.
        ii. Indirect contact involves an intermediate object, such as a contaminated trial contact lens or gloves that are not changed between patients.
    b. Droplet transmission occurs when droplets are generated from a source usually during talking, coughing, and sneezing. Droplets containing pathogens from the infected person are propelled a short distance (less than 3 feet) and deposited on the host's conjunctiva, nasal mucosa or mouth.
    c. Airborne transmission occurs when evaporated droplets or dust particles containing microorganisms remain suspended in the air for long periods of time. They can be carried by air currents and dispersed over longer distances from the source patient and inhaled by a susceptible host.
    d. Common vehicles include materials such as blood, food and water that serve as intermediate means of transport to the susceptible host.
    e. Vectorborne transmission involves insects, rodents and other "vermin" that transmit the pathogen to the host. Malaria, which is transmitted via mosquitoes, is a classic example of vectorborne infectious disease.
5. Portals of entry: sites and mechanisms by which pathogens are introduced to the host. Entry sites include mucous membranes, non-intact skin, genitourinary tract, and the placenta. A pathogen may also be carried on an object that breaks the integrity of the host's normal defense mechanisms, such as a surgical instrument or blood transfusion.

6. A susceptible host is a person who lacks effective resistance to the pathogen. Susceptibility is influenced by genetics, hormones, nutritional status, age, the presence of other disease, and behavioral patterns.

Once the circle of infection has been completed, there are many factors that impact the outcome of the exposure.

1. Impairment of host defenses includes factors such as advanced age, chronic or acute disease, or medical treatment. Natural barriers such as intact skin, gastric acids, and integrity of the tear film may be compromised by these factors. Alterations in the immune system (T cells, antibodies, inflammatory responses) by any of these same factors can also mediate the outcome of the exposure.
2. Agent factors that increase the risk of infection include greater virulence of the pathogen, larger size of the inoculum, and longer duration of exposure. Certain routes of exposure are associated with increased risk of infection for a particular pathogen, as well.
3. Environmental factors such as ventilation systems can also play a role in the outcome of exposure. For example, recirculation of air on airplanes increases the risk of infection.

PREVENTION

Prevention of infectious disease must break the "chain of transmission." The specific place where the chain is broken will depend upon the pathogen. The first step in prevention is the recognition and control of reservoirs.

Recognition includes observing for signs of and symptoms of disease such as fever, pain, and red burning eyes. Once potential disease is recognized, diagnostic testing would be indicated to confirm the presence of infectious disease and identification of the reservoir. Control of the reservoir might include administration of antibiotics, and elimination of environments that might support the chain of infection. For example, West Nile virus may be controlled by environmental measures that eliminate standing water where mosquitoes breed, and infection with EKC (keratoconjunctivitis from Adenovirus 8) can be reduced by not performing tonometry on persons diagnosed with conjunctivitis.

Controlling routes of transmission is another preventative measure. Examples of this strategy include:

- Hand washing—use either soap and water or waterless antibacterial products.
- Barriers—use of personal protective equipment such as gowns, masks, and gloves.

- Sterilization or disinfection of patient care equipment.
- Isolation—Isolate individuals with known infectious disease to decrease the transmission of specific pathogens. Schools practice isolation to prevent the spread of infectious disease by sending home children with "pink eye."
- Environmental practices—housekeeping, ventilation, waste management and laundry management are all environmental controls.
- Protect the host with appropriate immunizations against pathogens such as hepatitis, influenza, measles/mumps/rubella, etc.

PREVENTION--HAND HYGIENE

The term **hand hygiene** includes several procedures that are aimed at reducing the presence of transient flora. This can be achieved through either **hand washing or hand disinfection**. Hand washing refers to washing hands with a **detergent** and water or water alone. This action removes dirt and loose transient flora. Hygienic hand washing refers to the same procedure with the addition of an **antiseptic** agent to the detergent. Hand disinfection refers to the application of an antiseptic solution to the hands, such as a waterless hand gel.

- **Detergent—**Surfactants that possess a cleaning action, i.e. soap
- **Antiseptic agent—**antimicrobial substances that are applied to the skin to reduce the number of microbes. Examples include alcohols, chlorhexidine, iodine and chlorine. Alcohol has the most rapid bacteriocidal action of all antiseptics.
- **Waterless antiseptic agent—**an antiseptic agent that does not require the use of water. The hands are rubbed together until the agent has dried. The preferred antiseptic agent is alcohol

Hand hygiene is the single most effective method of reducing the spread of infection. Transient flora (contaminants) that are easily removed by hand-washing, are the leading cause of healthcare-associated infections. Numerous studies by the CDC have demonstrated that improvements in adherence to hand-hygiene procedures is associated with a significant decrease in the prevalence of infectious disease. Despite being taught the importance of this intervention, many healthcare professionals do not practice adequate hand hygiene procedures. Perhaps a familiarity with risk factors associated with poor adherence to hand hygiene practices will raise awareness and allow healthcare professionals to improve adherence.

According to the CDC, the observed risk factors for poor adherence to recommended hand hygiene practices include:

- male gender
- working during the week (versus the weekend)

- wearing gowns and gloves
- high number of patient care encounters per hour of patient care.

Self-reported factors for poor adherence to recommended hand hygiene practices include:

- handwashing agents causing dry skin
- inconvenient location/shortage of sinks
- insufficient time/understaffing
- interference with relationship with patient
- belief that wearing gloves eliminates the need for hand hygiene
- lack of knowledge of protocols
- forgetting

The selection of the appropriate hand hygiene procedure is based on the task being performed. In non-patient areas, the use of hand washing with plain soap is adequate. In patient care areas, antiseptic agents should be the norm. Alcohol based agents are the most effective.

Proper hand hygiene procedures and protocols:

When to wash your hands

- Wash hands often.
- Wash before and after patient contact.
- Wash after handling contaminated material.
- Wash after using the toilet.
- Wash whenever your hands are dirty.

How to wash your hands

- Wet hands and lather well.
- Use liquid soap in a pump dispenser.
- Vigorously rub hands for >15 seconds (make sure to include your palms, fingers, around the wrist and thumbs, and the back of your hand).
- Rinse under running water, fingertips down.
- Dry with paper towels.
- Use the paper towel to turn off the faucet.

The efficacy of hand hygiene can be maximized:

- Mechanical friction is necessary to remove dirt and contaminants.
- Warm running water rinses away loosened dirt/debris and contaminants.
- Soap removes contaminants by emulsifying the oils that hold these organisms; however, a bar of soap sitting in a pool of water can become a reservoir. Disposable, non-refillable soap dispensers are preferable.
- Locate sinks conveniently in patient care areas.
- Have foot, knee or elbow pedals when possible.
- Wash after patient contact, even if gloves were worn.
- Use waterless alcohol-based hand rubs when water is not available.

PREVENTION--UNIVERSAL PRECAUTIONS

"Universal precautions," as defined by CDC, are 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 health care. Universal precautions are designed to reduce the risk of transmission of pathogens from both recognized and unrecognized sources of infection in healthcare settings. Healthcare workers cannot always know when a patient is a reservoir for an infectious disease. Therefore, universal precautions are designed for the care of all patients regardless of any diagnoses or presumed infectious status. The use of universal precautions is a primary strategy in the prevention of nosocomial infections. Universal precautions are designed to prevent unprotected contact between the healthcare worker and

- Blood and all body fluids (semen, vaginal secretions, cerebrospinal, synovial, pleural, peritoneal, pericardial, and amniotic fluids. Universal precautions do NOT apply to feces, nasal secretions, sputum, sweat, **tears**, urine, and vomitus unless they contain visible blood).
- Mucous membranes.

Universal Precautions

1. All health-care workers should routinely use appropriate barrier precautions to prevent skin and mucous-membrane exposure when contact with blood or other body fluids of any patient is anticipated. Gloves should be worn for touching blood and body fluids, mucous membranes, or non-intact skin of all patients, for handling items or surfaces soiled with blood or body fluids, and for performing venipuncture and other vascular access procedures. Gloves should be changed after contact with each patient. Masks and protective eyewear or face shields should be worn during procedures that are likely to generate droplets of blood or other body fluids to prevent exposure of mucous membranes of the mouth, nose, and eyes. Gowns or aprons should be worn during procedures that are likely to generate splashes of blood or other body fluids.
2. Hands and other skin surfaces should be washed immediately and thoroughly if contaminated with blood or other body fluids. Hands should be washed immediately after gloves are removed.
3. All health-care workers should take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices during procedures; when cleaning used instruments; during disposal of used needles; and when handling sharp instruments after procedures. To prevent needlestick injuries, needles should not be recapped, purposely bent or broken by hand, removed from disposable syringes, or otherwise manipulated by hand. After they are used, disposable syringes and needles, scalpel blades, and other sharp items should be placed in puncture-resistant containers for disposal; the puncture-resistant containers should be located as close as practical

to the use area. Large-bore reusable needles should be placed in a puncture-resistant container for transport to the reprocessing area.

4. Although saliva has not been implicated in HIV transmission, to minimize the need for emergency mouth-to-mouth resuscitation, mouth- pieces, resuscitation bags, or other ventilation devices should be available for use in areas in which the need for resuscitation is predictable.
5. Health-care workers who have exudative lesions or weeping dermatitis should refrain from all direct patient care and from handling patient-care equipment until the condition resolves.
6. Pregnant health-care workers are not known to be at greater risk of contracting HIV infection than health-care workers who are not pregnant; however, if a health-care worker develops HIV infection during pregnancy, the infant is at risk of infection resulting from perinatal transmission. Because of this risk, pregnant health-care workers should be especially familiar with and strictly adhere to precautions to minimize the risk of HIV transmission.
7. Implementation of universal blood and body-fluid precautions for ALL patients eliminates the need for use of the isolation category of "Blood and Body Fluid Precautions" previously recommended by CDC for patients known or suspected to be infected with blood-borne pathogens. Isolation precautions should be used as necessary if associated conditions, such as infectious diarrhea or tuberculosis, are diagnosed or suspected.

Element III

Use of Engineering and Work Practice Controls to Reduce the Opportunity for Patient and Healthcare Worker Exposure to Potentially Infectious Material

Learning Objectives
At the conclusion of course work on this element, the learner will be able to:

- Define "engineering controls" and "work practice controls".
- Describe specific practices and settings which increase the opportunity for exposure to healthcare workers and patients.
- Identify where engineering or work practice controls can be utilized to prevent exposure.

Engineering/Environmental controls are interventions that, by design and function, reduce the opportunity for the patient and the healthcare worker exposure to potentially infectious materials. Engineering controls aimed at reducing exposure to bloodborne pathogens include:

- Puncture resistant sharps disposal containers
- Splatter shields

Sharps containers should be **functional**, **accessible**, **visible** and **accommodating**.

- Functionality – They should be durable, closable, leak resistant, and puncture resistant. Closure mechanisms should minimize exposure to contents and injury to the hands. Once activated, the final closure mechanism should be resistant to manual opening. A sufficient number of containers should be available in the appropriate size and shape.
- Accessibility— Containers should be accessible to workers who use, maintain, or dispose of sharps. They should be conveniently located within the workplace.
- Visibility—Containers should be visible to workers who use them. They should carry a biohazard warning label. According to OSHA, "These labels should be fluorescent orange or red-orange, with lettering or symbols in a contrast color." The biohazard symbol and the word "Biohazard" should be displayed.
- Accommodation—The containers should be easy to operate and not require significant worker training. Design should promote one-hand operation/disposal. Mounting systems should be safe, stable and if indicated, lockable.

Work practice/administrative controls reduce or eliminate the likelihood of exposure by altering the manner in which a task is performed. Work practice controls aimed at reducing exposure to bloodborne pathogens include:

- Discarding of sharps WITHOUT RECAPPING (Past studies have demonstrated that 10-25% of needlestick injuries occurred when recapping a used needle).
- Enforcing proper hand hygiene protocols.
- Enforcing the use of personal protective equipment (PPE) when appropriate.
- Prompt cleaning of blood and body fluid spills using appropriate disinfectant.
- Proper disposal/handling of blood and body fluids, including contaminated patient care items (sharps, laundry, etc.)
- Mandating infection control education for all healthcare professionals.
- Requiring immunization of healthcare professionals.

Environmental and work practice controls are also effective at reducing exposure to airborne pathogens (including tuberculosis). Source control is an important intervention in reducing exposure. Early identification of infected (or possibly infected) individuals allows for isolation, treatment, and education. Engineering controls include isolation rooms with negative pressure. Work practice controls include enforcement of the use of HEPA filter respirators when entering rooms of patients with suspected or confirmed TB.

Element IV

Selection and Use of Barriers and/or Personal Protective Equipment for Preventing Patient and Healthcare Worker Contact with Potentially Infectious Material

Learning Objectives
At the conclusion of course work on this element, the learner will be able to:

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

Personal protective equipment (PPE) is defined as specialized clothing or equipment worn by healthcare workers for protection against a hazard. PPE reduces the healthcare workers' exposure to hazards when engineering and work practice controls are not feasible or effective in reducing risk of exposure. Employers are required to identify all potential exposure risks in the workplace and determine if PPE should be used to protect healthcare workers.

A **barrier** is an object that separates a person from a hazard.

The most common used PPE are gloves. There are 3 reasons for healthcare workers to wear gloves:

1. To reduce the potential for the healthcare worker to become infected with a pathogen from a host.
2. To reduce the chance that the healthcare worker will transmit pathogens to patients.
3. To reduce the risk of transmitting a pathogen from one patient to another.

Gloves are for **single use only**. They are **disposable**. Gloves must be **changed for every patient. Hands should be washed after removal** of gloves.

Gloves may be sterile or non-sterile. Routine patient care activities (non-invasive) may be performed with non-sterile gloves. Surgical procedures, procedures with susceptible hosts, and the preparation and administration of medications and fluids require sterile gloves.

Gloves are made from many materials. Because of the increased recognition of the dangers associated with repeated latex exposure and cases of latex allergy, the use of latex gloves should be avoided. If latex gloves are being used, only use the powder free gloves. Other materials include vinyl, nitrite/rubber (utility gloves), and polyethylene (food handling gloves).

Cover garb include gowns, aprons and lab coats. These are used when the healthcare worker is likely to come in contact with infective fluids and to prevent the soiling of clothing when performing these activities. Cover garb can be disposable or launderable.

Masks are used to prevent the transmission of pathogens through the air. They protect the wearer from inhaling large particles (droplets) and small particles (droplet nuclei).

Other PPE include face shields, eye protection such as goggles and safety glasses, shoe and head covers, procedure drapes, and wound dressings.

Choose the appropriate PPE based on the interaction between the patient and the healthcare worker. When coming in contact with blood or body fluid splash, use gloves, gown, face shield or mask and protective eyewear. When contact with blood or body fluids is minimal, wear gloves. If performing an invasive procedure requiring sterile barriers, use gowns, gloves and dressings.

The proper application of PPE/barriers will protect the healthcare worker and patients. The following guidelines should be considered to maximize their use and effectiveness:

- PPE should be accessible and conveniently located.
- PPE must fit properly.
- Quality control standards should be considered when purchasing supplies. The integrity of the barrier provided by any product must be maintained.
- Consider cost, integrity of the barrier, ease of processing, and medical waste regulations when choosing disposable or reusable products.
- Monitoring the compliance of healthcare workers under your supervision is mandatory. The risk of cross-contamination is high if PPE is not changed between patients.

The implications of over/under utilization of PPE/barriers include cost, cross contamination of patients, and exposure of healthcare workers to pathogens.

Element V

Creation and Maintenance of a Safe Environment for Patient Care Through Application of Infection Control Principles and Practices for Cleaning, Disinfection and Sterilization

Learning Objectives
At the conclusion of course work on this element, the learner will be able to:

- Recognize the importance of the correct application of reprocessing methods for assuring the safety and integrity of patient care equipment
- Identify the individual's responsibility for maintaining a safe patient care environment.
- Recognize strategies for effective pre-cleaning, chemical disinfection, and sterilization of instruments and devices.

Contamination—The presence of microorganisms on inanimate objects (clothes, instruments) or substances (water, food).

Decontamination—The process of removing disease-producing microorganisms and rendering an object safe for handling. Cleaning, disinfection and sterilization are all decontamination processes. They differ in the number and types of microorganisms killed.

1. **Cleaning**—the removal of foreign material (dirt, debris) from an object, using water, soap, or detergents, and washing or scrubbing the object.
2. **Disinfection**—process that results in the elimination of many or all microorganisms with the exception of bacterial endospores.
    - High level disinfection kills bacteria, (TB), fungi, viruses and some bacterial spores.
    - Intermediate level disinfection kills bacteria (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 gram-negative rods (pseudomonas) and myobacteria.
3. **Sterilization**—A process that completely eliminates all forms of microbial life. Accomplished by the use of steam pressure, dry heat, or the use of liquid chemicals and a prolonged soaking time.

The potential for contamination is dependent upon the type of device, instrument or environmental surface. Factors that have contributed to the contamination include:

- Inadequate cleaning/disinfection/sterilization processes.
- Contamination of disinfectants or rinse solutions.
- Reuse of disposable equipment

The level of reprocessing (cleaning/disinfection/sterilization) is dependent upon the use of the item and the associated risk of infection. Critical instruments are those that are introduced directly into the body, blood stream or normally sterile areas of the body.

This includes scalpels, needles, dental instruments and endoscopic instruments. They require sterilization. Semi-critical instruments are those that come in contact with mucous membranes or non-intact skin. Examples include anesthesia and respiratory therapy equipment and high level disinfection is required. Thermometers require intermediate level disinfection. Non-critical instruments come in contact with the patient, but with usually unbroken skin. These items include stethoscopes, occluders, chinrests, and countertops. They require low level disinfection.

The selection of a disinfectant depends on the level of anti-microbial activity required.

- High level—glutaraldehyde, 3-6% hydrogen peroxide, bleach
- Intermediate level—alcohol, bleach, phenolics
- Low level—phenolics, iodophor

Disinfectants must be approved by the Environmental Protection Agency (EPA). Every healthcare agency must maintain a Material Safety Data Sheet (MSDS) for each agent/product, which provides information on the safe handling, use and storage of the agent. Disinfectants should be used in well-ventilated areas with no contact to the worker's skin or mucous membranes. PPE should be utilized if recommended by the manufacturer. Once the item has been disinfected, use appropriate procedures to rinse, dry and store where recontamination cannot occur.

The selection of sterilization methods for critical instruments depends on cost, availability of the instrument, trained personnel, and compatibility of the sterilization method with the item requiring sterilization.

Methods of sterilization include:

- Moist heat with steam under pressure (autoclave).
- Flash sterilization—270 degrees F for 4 minutes
- Ethylene oxide gas (ETO) for heat sensitive items (plastic, rubber)
- Chemicals—glutaraldehyde, hydrogen peroxide, bleach

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

Environmental cleaning includes the routine cleaning and disinfection of work surfaces such as countertops, faucet handles, occluders, stethoscopes and writing instruments. All surfaces that come into contact with patients should be cleaned and disinfected daily.

Specific Procedures for Disinfection in the Optometric Practice

1. Examination Rooms—occluders, phoropter, chairs, chin and forehead rests, condensing lenses.
    a. Before every patient encounter, be sure to use alcohol wipes to disinfect all surfaces that come into contact with patient.
    b. Cleaning counter tops should occur between each patient encounter.

2. Hand Instruments—forceps and other instruments are swabbed with an alcohol prep and transported in a stainless steal basin or the sterilized bag from which it was originally removed, to the nurse (6^{th} floor) or clinic manager (7^{th} floor) for heat sterilization.
    a. Following use, needles are discarded in the sharps container located on the clinic floor.
    b. Gonio lenses should be swabbed with an alcohol prep between each use.
3. Applanation tonometers
    a. Before each patient encounter, rub tonometer tip with alcohol wipe. This is effective against most microorganisms (pseudomonas, staphylococcus, HIV, HCV) EXCEPT Acanthomoeba.
    b. tono tips should be soaked in 3% hydrogen peroxide for 2 hours for all ‘at risk patients (i.e. patients with a current history of home-made saline preparations, contact lens patients with infectious keratitis). This is required to kill Acanthomoeba.
4. Contact lenses—Soft contact lenses and RGPs
    a. Clean with surfactant
    b. Disinfect with 2 hour soak in 3% hydrogen peroxide.
        i. 10-15 minutes, effective against most bacteria and HIV.
        ii. 1 hour effective against fungi.
        iii. 2 hours required to kill Acanthomoeba
    c. Neutralize soft lenses for 10 minutes; rinse RGPs with sterile solution.
    d. Store soft lenses in a preserved solution; store RGP lenses dry.
    e. Repeat disinfection after 30 days of storage.
    f. Clean or replace storage case after 30 days.
    g. Discard opened bottles of solutions after 1 day if unpreserved and 1 week if preserved.

Element VI
Prevention and Control of Infectious and Communicable Diseases in Healthcare Workers

Learning Objectives
At the conclusion of course work on this element, the learner will be able to:

- Recognize the role of occupational health strategies in protecting healthcare workers and patients.
- Recognize non-specific disease findings which should prompt evaluation of healthcare workers.
- Identify occupational healthcare strategies for preventing bloodborne pathogens and other communicable diseases in healthcare workers.
- Identify resources for evaluation of healthcare workers infected with HIV, HBV, and/or HCV.

Infectious disease—a clinically manifest disease of man or animal resulting from an infection.

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.

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.

The goals of occupational health strategies are a two–way street: prevent the transmission of infectious disease from healthcare workers to patients and from patients to healthcare workers. Elements III, IV, and V have discussed strategies aimed at protecting the healthcare worker from exposure. Element VI emphasizes post exposure management of the healthcare worker as well as strategies for protecting the patient.

Protecting the Patient

Strategies to assess the health status of healthcare workers include pre-employment and annual physicals, requirement for immunizations, and evaluation of acute illnesses.

- Pre-employment physicals and annual health assessments include a history of immunizations, a PPD-TB test and evaluation of chronic disease.
- Immunization/screening programs are implemented to maintain the health of healthcare workers and reduce the risk of transmission to patients. The diseases targeted include rubella, rubeola, hepatitis B, tuberculosis and influenza. In NY State, regulations require a certificate of immunization or proof of immunity (via measurement of blood antibody titers) to rubella and rubeola, and a PPD-TB test with follow-up for positive results. Recommended immunizations are hepatitis B, influenza, measles, mumps and rubella.

- Evaluation of healthcare workers is based on evidence of signs and symptoms of illness or exposure to an incubating illness.
    - Symptoms that should prompt evaluation for "work fitness" include fever, chills, cough, skin lesions, sores, vomiting, etc.
    - Post-exposure evaluation for incubating diseases in a susceptible host is dependent upon the disease. Strategies include prompt evaluation, prophylactic treatment, furlough until non-infectious, and/or limiting contact with patients and other healthcare workers.
- Evaluation of healthcare workers infected with HIV, HBV or other bloodborne pathogens is based on the premise that HIV or HBV infection alone is not sufficient justification for limiting professional duties. Determining whether job modification is indicated requires a case by case analysis that considers several factors such as physical or mental condition and compliance with infection control protocols. However, all healthcare institutions are responsible for ensuring that their employees do not have any impairments that would interfere with patient care or pose a risk to patients (and other healthcare workers). Evaluations of individuals with known HIV or HBV should involve consultation with an infectious disease physician, a representative from the infected healthcare worker's practice area and the infected worker's personal physician. HIV-infected healthcare workers are entitled to the same protections under the NYS HIV Confidentiality Law as any other citizen. HIV testing of any citizen without written, informed consent is prohibited, and healthcare workers are not required to disclose their HIV status to patients or employers. Similarly, healthcare facilities are under no obligation to disclose the HIV/HBV status of their employees to patients. If a healthcare worker exhibits behavior patterns that are high risk or has had an occupational exposure, they should be counseled about the importance of learning their HIV/HBV status to protect themselves as well as patients under their care. All evaluations/counseling must be handled with complete confidentiality.

Post-Exposure Management of the Healthcare Worker:

Bloodborne Pathogens

When a healthcare worker is exposed to blood, semen, vaginal secretions, or mucous membranes, medical management may be required. The exposure should be categorized as massive, definite parenteral, possible parenteral, doubtful parenteral or non-parenteral exposure. The person who is the source of the exposure should be informed and interviewed for information concerning the risk of transmission of infectious disease. Permission for HIV, HBV, HCV testing should be considered to further evaluate the risk of infection. The healthcare worker should also have their immune status tested (via history of vaccination or antibody titers). Post exposure prophylaxis may be indicated, based on the risk of transmission of infection.

Airborne or Droplet Pathogens

If the healthcare worker is exposed to TB, they should receive a PPD-TB test as soon as possible to serve as a baseline. A second PPD test performed 12 weeks after the exposure will indicate whether infection has occurred (persons with a positive PPD test should not be retested). If there is evidence of new infection (conversion of PPD test), then further evaluation is indicated. Even if active TB is not diagnosed, preventive therapy with isoniazid should be considered. Any healthcare worker with active TB poses a significant risk to patients and other personnel and must be excluded from work until treatment is initiated and they are no longer infectious. Documentation must be provided attesting to this before they are allowed to return to work.

Infectious Disease – A Public Health Perspective

As optometrists in clinical practice, it is easy to lose sight of the global battle that is being fought against infectious disease. Optometrists are not directly involved in either the treatment of many of these diseases or controlling their transmission. However, as primary care providers examining patients in a variety of healthcare settings, we are more likely to encounter patients with infectious disease, especially those with ocular manifestations. Certainly infection control practices are essential to protect ourselves and our patients. In addition, the expansion of scope of practice to include the prescription of oral medications brings a growing responsibility to understand infectious disease from a perspective that moves beyond the treatment of ocular disease. Optometrists must consider how prescribing impacts the rise and fall of infectious disease both in our communities and around the world. Antibiotic resistant bacteria are increasing and threaten the public worldwide with increasing incidence of infectious disease, decreasing effective treatments and a resultant increase in mortality from infectious disease.

Antibiotic resistance is a natural phenomenon. When an antibiotic is utilized, the "defenseless" bacteria are killed but those that can "survive" the antibiotic attack are left to flourish. Genetic mechanisms allow bacteria to pass on their resistance, and they may become resistant to multiple antibiotics. Although antibiotic resistance is a natural phenomenon, the process is being accelerated by overuse of antibiotics. More people are contracting infectious disease, ranging from inner ear infections in young children to salmonella infections from tainted peanut products. Often doctors are being pushed to prescribe antibiotics by their patients, despite evidence that the underlying disease is in all likelihood viral. The increasing use of antibiotics creates a vicious cycle, as more resistant bacteria cause more infectious disease and the prescription of more antibiotics. The use of antibiotics in animals has played an important role in increasing antibiotic resistance. Seventy percent of the antibiotics used in the United States are administered to animals. Industrial farming practices raise these animals in crowded filthy feedlots where antibiotics are used to prevent them from becoming sick and to allow them to come to market quickly. Antibiotic resistant bacteria are entering kitchens across America on contaminated meat.

The research and development of new antibiotics has been abandoned by many pharmaceutical companies, who are looking for blockbuster treatments for chronic disease that must be taken on a daily basis. Antibiotics are typically short-term treatments and when new ones are introduced into clinical practice, doctors are told not to prescribe them in order to "keep them in reserve for tougher bugs." Faced with the double reality of increasingly virulent infectious disease and a more limited repertoire of effective antibiotics, clinicians must practice "antibiotic stewardship," which begins with an emphasis on infection control practices.

Perhaps no other infectious disease is more relevant to this discussion than Tuberculosis (TB), especially when one considers its mode of transmittance and its ocular manifestations. An estimated one third of the world's population is infected with

Mycobacterium tuberculosis, and nearly 9 million persons develop disease caused by M. tuberculosis each year. Although Tuberculosis occurs predominantly in resource-limited countries, in the United States, approximately 13,000 new cases of TB are reported annually, and 650 persons die from TB each year. TB is the leading cause of mortality among persons infected with HIV. From 1985--1992, the United States was confronted with an unprecedented TB resurgence. This resurgence was accompanied by a rise in multidrug-resistant TB (MDR TB), which is defined as TB that is resistant to the two most effective first-line therapeutic drugs, isoniazid and rifampin. More recently, virtually untreatable strains of M. tuberculosis are emerging globally. Extensively drug-resistant (XDR) TB is defined as MDR TB that also is resistant to the most effective second-line therapeutic drugs used commonly to treat MDR TB: fluoroquinolones and at least one of three injectable second-line drugs used to treat TB (amikacin, kanamycin, or capreomycin). XDR TB has been identified in all regions of the world, including the United States. Because of the limited responsiveness of XDR TB to available antibiotics, mortality rates among patients with XDR TB are similar to those of TB patients in the pre-antibiotic era. In addition, the global TB epidemic directly affects the United States because the majority of all cases of TB and 80% of cases of MDR TB reported in the United States occur among foreign-born persons. Unless the fundamental causes of MDR TB and XDR TB are addressed in the United States and internationally, the United States is likely to experience a growing number of cases of MDR TB and XDR TB that will be difficult, if not impossible, to treat or prevent. Effective infection-control practices are critical to prevent the transmission and further spread of MDR and XDR TB in health-care settings and other congregate settings (e.g., correctional facilities and nursing homes). Testing workers for TB in various healthcare settings is an important strategy for identifying individuals infected with TB and detecting unsuspected transmission.

Any discussion of infectious disease and its relevance to optometric practice should include mention of the outbreak of Fusarium keratitis that occurred in 2005-2006. Between June 2005 and May 2006, the CDC received reports of 130 confirmed cases of Fusarium keratitis infection, defined as clinically consistent fungal keratitis and a corneal culture yielding a Fusarium species. As a result of this infection, corneal transplantation was required in 37 cases. Among the 130 patients with confirmed cases, 125 reported wearing contact lenses, and the vast majority reported using Bausch & Lomb's ReNu with MoistureLoc. On April 13, Bausch & Lomb withdrew this product from the market in the United States and subsequently ceased its production. An inspection of the manufacturing plant never identified a point of entry or source of contamination. Bausch & Lomb was forced to conclude that something about the MoistureLoc formulation was increasing the risk for Fusarium keratitis and that the only option was to permanently remove this solution from the worldwide market. The American Optometric Association was instrumental in launching an effective public education campaign to alert contact lens wearers to discontinue use of this product and to consult with their eyecare professional to discuss alternate products and any other concerns. Although optometrists were not the source of the problem, they were an integral part of the public health oriented solution.

In summary, optometrists must practice infection control procedures in order to protect themselves and their patients. The best defense against the rising tide of antibiotic resistant bacteria is to prevent infection from occurring. As primary care practitioners, including the authority to prescribe oral medications, optometrists must acknowledge the need to fight infectious disease globally, by practicing responsibly and staying informed about new and evolving diseases.

Self-Assessment Questions

1. Failure to use scientifically accepted infection control techniques may result in

a. charges of unprofessional conduct
b. revocation of professional license
c. legal action for liability
d. all of the above

2. The "Chain of Infection" includes 6 elements. Which of the following best describes the relationship between the 6 elements and infectious disease?

a. Only 4 elements are required for an infection to occur.
b. The chain can be broken only at the "mode of transmission" link.
c. All 6 elements are required for an infection to occur.
d. The number of elements differentiates between acute and carrier states of infectious disease.

3. A reservoir is defined as

a. a person who lacks effective resistance to the pathogen.
b. a site at which pathogens are introduced to the host.
c. places from which the pathogen passes to a host via a vehicle of transmission.
d. places where organisms live and grow.

4. A nosocomial infection is defined as

a. in infection that is transmitted via respiratory secretions.
b. an infection that was not present prior to admittance to a hospital or other healthcare setting.
c. an infection that is enters the host through mucous membranes.
d. an infection that occurs in an immune-compromised host.

5. Which of the following factors would NOT impact the outcome of an exposure to an infectious disease?

a. the use of a nosocomial barrier system.
b. age of the host.
c. virulence of the pathogen.
d. the use of ventilation systems

6. In order to increase the efficacy of hand hygiene,

a. rub hands together over the sink to allow dirt to fall into the sink instead of onto the floor.
b. Cover a bar of soap in water to allow the oil to emulsify.

c. Locate sinks next to personal protection equipment (such as gloves and gowns).
d. Have foot, knee, or elbow water controls on the sinks when possible.

7. The single most effective method of reducing the spread of infection is
a. isolation.
b. disinfection of patient care equipment.
c. use of gloves.
d. hand washing.

8. Universal precautions
a. are designed for the care of high risk patients with known infectious disease.
b. are designed to prevent contact between the healthcare worker and blood and all body fluids.
c. are designed to prevent needle-stick injuries.
d. are practiced only in hospitals providing care to HIV patients.

9. Which of the following is considered a work practice control aimed at eliminating or reducing exposure to bloodborne pathogens?
a. asking patients to wash their hands.
b. isolation of patients with TB.
c. discarding sharps without recapping.
d. prescribing antibiotics to patients with known infectious disease.

10. Which of the following diseases is a classic example of vectorborne transmission?
a. Tuberculosis
b. Malaria
c. HIV/AIDS
d. Fusarium Keratitis

11. In order to increase the efficacy of PPE,
a. compliance with their use by healthcare personnel should be monitored.
b. they should be made available from 1 location in order to monitor supplies.
c. they should be available in "one size fits all" to be sure they can be worn by all healthcare personnel.
d. they should be sterilized after each use.

12. What was the cause of the Fusarium Keratitis outbreak that occurred in 2005-2006?
a. contaminants in the contact lens cases distributed by Bausch and Lomb
b. an antibiotic resistant bacteria that was not killed after routine contact lens disinfection procedures.
c. The cause was never linked to a particular contaminated process or product.
d. A contaminated lot of Bausch & Lomb Renu with MoistureLoc contact lens care solution

13. Which of the following defines disinfection?

a. The process of removing disease producing microorganisms and rendering an object safe for handling.

b. The removal of foreign material from an object, using soap, water or detergents and washing and scrubbing the object.

c. A process that eliminates many or all the microorganisms with the exception of bacterial endospores.

d. A process that completely eliminates all forms of microbial life.

14. Sterilization of instruments may be accomplished using all of the following EXCEPT

a. steam pressure

b. dry heat

c. soaking in chemicals for a prolonged period of time

d. pasteurization

15. An MSDS is

a. a hydrogen peroxide-based disinfectant

b. a special filter worn when providing care to patients with TB.

c. a chemical used in contact lens solutions as a preservative.

d. a data sheet for each chemical agent which provides information on safe handling, use and storage.

16. Which of the following describes the best infection control practice for tonometer tips in optometric practice? The tonometer tip should be

a. swabbed and rubbed with an alcohol wipe before every patient encounter.

b. swabbed and rubbed with an alcohol wipe after every patient encounter.

c. soaked in 3% hydrogen peroxide after every patient encounter.

d. swabbed and rubbed with an alcohol wipe after performing tonometry on each eye.

17 . In order to kill Acanthomoeba, RGP contact lenses should be soaked in 3% hydrogen peroxide for a minimum of

a. 10-15 minutes

b. 1 hour

c. 2 hours

d. 8 hours

18 . Which of the following is a viable occupational health strategy designed to protect the patient?

a. The use of isolation rooms and ventilation systems.

b. Requiring a pre-employment physical and annual health assessment.

c. Testing all employees for HIV status.

d. Locating sharps containers in accessible locations.

19. The evaluation of healthcare workers infected with HIV or other bloodborne pathogens

a. must include paid leave until the worker is no longer infectious.
b. requires disclosure of HIV status.
c. should not involve consultation with the individual's personal physician.
d. must be cognizant of the fact that infected healthcare workers are entitled to the same protections under NYS law as any other citizen.

20. Which of the following might result in contamination?

a. reusing single-use equipment without reprocessing.
b. disinfecting a tonometer tip by wiping and rubbing with an alcohol wipe.
c. rinsing disinfected items with sterile water.
d. soaking RGP contact lenses in a hydrogen peroxide solution for 2 hours.