

Infection Control

Course Introduction

Reducing the transmission of infectious diseases is a major concern for healthcare professionals. With the advent of HIV, and the resurgence of tuberculosis, infection prevention and control is one of your most important responsibilities as a home healthcare worker. By watching this videotape and studying the accompanying workbook, you will learn effective procedures which you can apply in the home healthcare setting to protect yourself and clients from infection.

Terminology

AIDS Acquired Immune Deficiency Syndrome. Disorder caused when HIV damages the immune system.

Bloodborne Viruses or disease spread by contact with blood and certain body fluids.

Carrier A person or animal capable of transmitting pathogens.

Centers for Disease Control (CDC) The U.S. agency that tracks the spread of diseases. It developed Universal Precautions for controlling HIV, HBV, and HCV in the workplace, as well as other safety procedures.

Chain of Infection The process by which infectious disease occurs.

Disease A pathological condition of the body that presents a group of symptoms peculiar to it.

Droplet nuclei Minute droplets of fluid.

Gastrointestinal Pertaining to the stomach and intestines.

Genitourinary Pertaining to the genitals and urinary organs.

HIV Human immunodeficiency virus; the virus thought to cause AIDS.

HEPA High Efficiency Particulate Air filter.

Hepatitis B Virus (HBV) Virus that causes hepatitis B.

Hepatitis C Virus (HCV) Virus that causes hepatitis C.

Hyperimmune Globulin Substance that helps that body fight off HBV infection.

Induration An area of hardened tissue.

Infection A condition of the body or part of the body when it is invaded by a potentially harmful bacteria or virus.

Immune Able to resist an infection or disease.

Jaundice Yellowing of the eyes and skin sometimes caused by the hepatitis virus.

Micron A micrometer; one millionth of a meter.

Mode of transmission The mechanism by which the pathogen is transmitted from the reservoir to a susceptible host.

Mucous membranes tissue that lines the eyes, nose, and mouth.

Multi-drug resistant A condition where a pathogen causing an infection can resist the effects of more than one drug.

Occupational Safety and Health Administration (OSHA) U.S. government agency that develops and enforces standards for workplace safety and health.

Pathogen A bacterium, virus, fungus, parasite, or other microorganism or substance capable of causing disease.

Portal of entry the path by which the pathogen enters the reservoir.

Portal of exit The path by which the pathogen leaves the reservoir.

Reservoir The environment in which the pathogen exists and reproduces.

Susceptible host Person lacking the ability to resist a pathogen.

Universal Precautions A method for infection control in which all human blood and certain body fluids are treated as if they are known to be infectious.

Vaccine Substance capable of producing resistance or immunity to a disease.

VIDEOTAPE CONTENT REVIEW

Review the material presented in the videotape by studying the next pages. It also presents supplementary information.

THE PRINCIPLES OF INFECTION CONTROL

The chain of infection is the process by which infectious disease occurs. The chain of infection begins with the presence of a pathogen or causative agent. A pathogen is a bacterium, virus, fungus, parasite, or other microorganism or substance capable of causing disease.

The environment in which the pathogen exists and reproduces is called a reservoir. An animate reservoir is often the human body, but it can also be an animal. An inanimate reservoir is an object in the environment. For example, a reservoir for hepatitis A virus could be clams; for salmonella, milk; for chicken pox, the human body. But the human body can also be a reservoir without showing any symptoms of the disease.

The portal of exit is the path by which the pathogen leaves the reservoir. A portal of exit may be the respiratory tract, such as when pathogens are coughed or sneezed into the air. It may be the genitourinary tract, or gastrointestinal tract as waste products are excreted. The pathogens may exit the body through the skin or mucous membranes, such as draining lesions.

The mode of transmission is the mechanism by which the pathogen is transmitted from the reservoir to a susceptible host, a person who may then become infected. There are four types of modes of transmission:

1. Contact transmission may be direct, indirect, or droplet spread.
 - Direct contact is the person-to-person spread of the pathogen where there is actual physical contact between the source and susceptible host.
 - Indirect contact occurs when there is a contaminated object involved in the transmission.
 - Droplet spread occurs when large particles containing the pathogens travel through the air to the susceptible host.
2. Airborne transmission involves the suspension of droplet nuclei in dust particles in the air.
3. Common vehicle transmission is the transfer of pathogens to multiple persons through contact with a contaminated object, such as food, water, or blood products.
4. Vectorborne transmission is the spread of microorganisms by contact with insects, such as ticks, mosquitoes, or fleas.

The portal of entry is the path by which a pathogen enters the susceptible host. It may be the respiratory tract, such as when pathogens are inhaled. Pathogens may enter the genitourinary tract, or the gastrointestinal tract by contaminated food, water or objects. A path of entry may be non-intact skin, such as a lesion or wound, and mucous membranes. Entry may also occur through surgical incisions, or the insertion of needles or other devices.

Finally, the susceptible host is the person lacking effective resistance to the particular pathogen they are exposed to, who then becomes infected.

Factors Influencing Outcome of Exposure

There are many factors that influence a person's susceptibility to a pathogen. Some factors are related to the characteristics of the susceptible host:

- Age – the very young and the very old are often at increased risk.
- Immune status.
- Nutritional status.
- Loss of natural barriers to infection, such as intact skin, respiratory cilia, gastric acid, and tears.
- Presence of other diseases, such as diabetes or AIDS.
- Impaired immune system.

Other factors are related to the characteristics of the pathogen and the circumstances of exposure:

- The virulence of the pathogenic organism.

- The amount of pathogens.
- The route of exposure – broken skin exposures are more efficient in transmission of blood borne pathogens than mucous membrane exposure.
- The duration of exposure – as exposure time increases, the likelihood of transmission increases.

PREVENTION STRATEGIES

There are several ways to break the chain of infection to prevent transmission of disease. The include:

- Identifying and controlling the reservoir.
- Controlling the route of transmission.
- Supporting and protecting the host.

Identifying and Controlling the Reservoir

The first strategy involves examining the patient’s environment for potential reservoirs of infection. These include:

- Home care staff.
- Patient’s family members and visitors.
- Items or equipment brought into the home.
- Improperly prepared or stored food and medication.

When a potential reservoir is identified, take immediate action to remove or minimize the threat of infection. Report any possible or known infections to your supervisor. If you or any member of the healthcare team shows symptoms of an illness, an evaluation must be done before entering a patient’s home. Also, you should instruct the patient and the patient’s family members in prevention strategies.

Controlling the Mode of Transmission

Controlling the mode of transmission is another important prevention strategy. Routine handwashing reduces the number of microorganism on the surface of the skin and is the single most effective procedure for preventing infections. You should always carry a supply of liquid soap and paper towels.

Be sure to wash your hands thoroughly:

- Upon entering and leaving each home.
- Before and after every patient contact.
- Following every bathroom use.
- After covering a cough or sneeze.
- After wiping the nose or other mucous membranes.
- Each time gloves are removed.
- Use the following procedure to ensure that the hand washing you perform is effective:
- First wet hands, then apply soap and work up a lather, being sure to reach all surfaces.
- Vigorously rub all surfaces of lathered hands for at least 10 seconds followed by thorough rinsing under a stream of water.
- Dry hands with a paper towel.
- Use paper towels to turn off faucets and turn bathroom doorknobs after hand washing.

Keep nails clean and neatly trimmed. Avoid wearing heavy or ornate jewelry that may harbor pathogens, interfere with hand washing, or puncture gloves. Germicidal solutions and towelettes can be used, but only as an interim measure. You must still wash your hands with soap and water at the first opportunity.

Using barriers, such as gloves, face masks, protective eyewear, gowns, and disposable coverings for equipment and surfaces protect both the patient and the healthcare worker.

Cleaning, disinfection and sterilization of patient care equipment, instruments, worker supplies, and work surfaces and maintaining aseptic techniques are also important means of controlling transmission.

Supporting and Protecting the Host

The third strategy is supporting and protecting the host. This may involve immunization, prophylaxis, or procedures to protect skin and the integrity of the immune system.

Immunization against vaccine-preventable disease for you, your patient, and members of the patient's family may be necessary. As a home healthcare worker, you are expected to maintain up-to-date immunizations as recommended by the Centers for Disease Control and Prevention Advisory Committee on Immunization Practices.

Prophylaxis may be necessary whenever it is learned that someone has come in contact with an infectious or communicable condition. Examples of diseases which require post-exposure prophylaxis include hepatitis B or hepatitis C, Meningococcal meningitis, pertussis, varicella and measles.

Protecting skin and immune system integrity is an important element of patient care. Underlying disease or injury may compromise skin integrity, the body's first line of defense against infection. It is important to protect sites which are susceptible to injury, particularly in the elderly and immobile, and to promote nutritional balance that not only supports skin integrity but also contributes to maintaining a healthy immune system.

Patients should be monitored for changes in condition which indicate a developing infection, and any changes should be reported immediately.

UNIVERSAL PRECAUTIONS FOR BLOODBORNE PATHOGENS

AIDS, HEPATITIS B AND HEPATITIS C

AIDS, hepatitis B and hepatitis C are bloodborne infections. This means that they are caused by pathogens that are found in the blood and body fluids of those infected. AIDS is caused by HIV, the human immunodeficiency virus. Hepatitis B is caused by HBV, the hepatitis B virus. Hepatitis C is caused by HCV, the hepatitis C virus.

HIV

HIV, the virus that causes AIDS, affects the body's immune system by limiting the ability of the body to fight off infection. The virus may be in the body for years before symptoms develop. A person infected with HIV may seem healthy, but is still a carrier capable of transmitting the virus to others during each phase of the development of disease.

The first symptoms of HIV infection are flu-like symptoms that may include fever, sweats, aches, swollen glands, sore throat, diarrhea, fatigue, or a rash. During this initial phase, some or all of the symptoms may disappear and a blood test may or may not show positive results. However, most persons infected with HIV eventually develop AIDS.

The AIDS patient has difficulty fighting off infections that a healthy person rarely gets or can fight off easily. Weight loss, frequent diarrhea, or a long-lasting fever may occur. The brain may be affected, causing confusion, memory loss, depression, or motor dysfunction. Serious infections, such as tuberculosis or an unusual kind of pneumonia may develop. A certain type of cancer or a serious infection eventually leads to death. Although there are drugs that may delay the onset of symptoms, there is currently no vaccine to prevent HIV infection, nor is there a cure for the disease.

HEPATITIS B AND HEPATITIS C

About half of those infected with the hepatitis virus will develop the disease.

What could happen to a person exposed to the HBV or HCV? The incubation period is from 45 to 160 days. During this time, the virus can be transmitted to others. About one-third of those infected do not experience symptoms. Another one-third of those infected experience only a mild flu-like illness that goes away. The last third experience abdominal pain, nausea, vomiting, loss of appetite and fatigue. The skin and eyes may become yellow in color, called jaundice. The urine may become dark. There may be joint pain, rash, and fever. More than 2 percent of all individuals infected with hepatitis will die.

Six to ten percent of all those infected with HBV or HCV become chronic carriers of the disease. Although there may be few or no symptoms, they can still transmit the disease to others. Carriers are at risk for chronic active hepatitis, a disease that affects the liver and can lead to serious illness and death. Carriers are also at risk for liver cancer.

The good news is that there is an effective vaccine to prevent HBV infection. There is also treatment that can be given after exposure to reduce the occurrence of infection in those who have not been vaccinated which is 90% effective when combined with the hepatitis B vaccine.

Occupational Risk

For AIDS, the risk of getting infected in the workplace is very small. As of September 1993, out of 5 million health care workers in the United States, 39 workers had been documented as infected with HIV through an occupational exposure. Most of these infections were caused by puncture wounds with contaminated needles or other sharps. But keep in mind that those infected with HIV are carriers for life, and the number of carriers is growing. This means that the percentage of patients carrying HIV is on the rise. It is estimated that there are 1.5 million HIV carriers in the United States.

For hepatitis B, the risk is greater. About 9000 U.S. healthcare workers get hepatitis B from occupational exposure each year. Between 400 and 500 are hospitalized, and about 200 die as a result. Recent surveys show that less than 50 percent of healthcare workers at risk of occupational exposure have been adequately vaccinated. In addition, there are almost 1 million carriers of HBV.

Transmission of Bloodborne Infection

Since bloodborne pathogens live inside the bodies of those infected, you should know which body fluids contain enough of the pathogens to transmit the disease.

A potential source of HIV, HBV, or HCV infection is any body fluid that may contain enough of the virus to transmit infection. The potential sources of infection are listed below.

- Blood.
- Body fluids that contain blood.
- Body fluids in situations where it is difficult or impossible to differentiate between body fluids.
- Semen and vaginal secretions.
- Fluid from around an unborn baby.
- Fluid from the spine, from around the heart, lungs, or joints.
- Body tissue.

Body fluids that are not believed to contain enough of HIV, HBV, or HCV to infect you are sweat, tears, sputum, nasal secretions, vomit, urine, and feces unless they contain blood. For purpose of infection control, one should treat all body fluids as if they are potential sources of infection.

Modes of Transmission

The ways in which infectious fluids get inside the body of another person are called modes of transmission. The primary modes of transmission outside the workplace are:

- Sexual contact, because of exposure to infectious semen and vaginal secretions
- Drug users sharing needles, because used needles are contaminated with blood
- Transfusions of infectious blood, although blood screening programs have almost eliminated this risk
- Pregnant mother to unborn baby
- Nursing mother to baby through contaminated breast milk, for HIV, not HBV

If you participate in risky behavior in your personal life, such as unsafe sex or sharing needles, your chances of becoming infected are increased.

Three major modes of transmission in the work place:

Puncture wounds from contaminated needles or other sharps account for most documented cases of occupational transmission. Between 7 and 30 percent of puncture wounds with HBV or HCV contaminated needles will transmit infection. Because the HIV virus is more fragile, only 0.5 percent of sticks with HIV contaminated needles results in infection.

Skin breaks, wounds, or cuts can allow infectious fluids to enter the body. Transmission can even occur at small or unseen breaks in the skin, such as the nicks around fingernails or those created by dry skin condition or rash.

Mucous membranes lining the eyes, nose, and mouth are a third mode of transmission. If you are splashed in the face with blood, or if you touch your eyes, nose, or mouth when you have blood on your hands, you could become infected.

You do not get these viruses through casual or environment contact. Shaking hands, using telephones, toilet seats, and drinking fountains will not result in infection. Donating blood is also a safe activity.

Controlling Exposure

OSHA, the Occupational Safety and Health Administration, has introduced a standard to control exposure to bloodborne pathogens based on guidelines developed by the Centers for Disease Control, or CDC. The steps that you will take depend on the nature of your work and the level of risk. If you never come into contact with blood or other body fluids on the job, your risk of being infected is not increased because of your job. But if your work includes direct patient contact, contact with used needles or other sharps, or contact with lab specimens, you will need to take steps to protect yourself. Your organization will provide guidance as to the appropriate measures you are to take.

Hepatitis B Vaccine

One of the most important things you can do to prevent hepatitis B infection is to be immunized before exposure. The Centers for Disease Control recommends immunization if you came into contact with blood or other potentially infectious body fluids on the job.

The hepatitis B vaccine is safe and is effective to between 92 and 96 percent of those vaccinated. It is administered in three injections given over a six month period. Blood tests can determine if the vaccination has been effective and if a booster injection is needed.

The vaccination is available free of charge upon completion of training and within 10 days of your first patient care assignment. Check with your supervisor for details.

Vaccination provides protection against hepatitis B, but currently there is no vaccine against hepatitis C.

UNIVERSAL PRECAUTIONS

Universal Precautions is a method for preventing the transmission of bloodborne infection. It is based on the concept that precautions should be taken with all patients because there is no way to know for sure who is infected and who is not. Patients infected with a bloodborne pathogen may not be ill or even know if they are infected, and test may not reveal the presence to pathogens. To observe Universal Precautions, you must:

- Treat all human blood, any body fluid containing blood, and any other potentially infectious body fluids as if they are known to be infectious.
- Treat all used needles or other sharps as if they are contaminated and able to transmit infection.

Even though you may perform tasks where there is a risk of exposure to bloodborne infections, you can still work safely by applying Universal Precautions. This means putting a barrier between you and the source of infection by using personal protective equipment. Such as gloves, face masks and protective face shields, and protective clothing.

Gloves

Gloves are the most commonly used type of personal protective equipment. Gloves must be worn:

- Whenever there is the possibility of touching or handling blood or other potentially infectious body fluids.
- When drawing blood or performing other invasive procedures.
- If you or the patient has sores, skin rashes, broken skin, bleeding or open wounds.

Non-sterile latex gloves or examination gloves are used for patient care procedures, such as drawing blood, removing a dressing or bathing a patient where there is the chance of contact with blood or body fluids. They are disposable and should be discarded after use with each patient.

Sterile latex gloves are used for invasive procedures, such as inserting a catheter. They are also disposable and should be discarded after use with each patient. General purpose utility gloves are used for cleaning procedures, such as

decontaminating patient care areas. They are more tear and puncture resistant than latex gloves. Utility gloves may be decontaminated and reused, but should be discarded if they have holes, crack, peel, or fade. Also, remember that even heavy utility gloves cannot protect you from needlestick injury.

Guidelines for Using Protective Gloves

When using protective gloves, follow the guidelines listed below:

- Remove all hand jewelry to prevent tearing the gloves.
- Wash your hands prior to wearing gloves.
- Wear gloves that are the correct size.
- Make sure that the gloves are free of holes and tears.
- Remove gloves properly by holding the first glove in the second hand, then grasping the other glove at the cuff and pulling it off inside out. This method avoids skin contact with the outside of the gloves.
- After each procedure dispose of latex or vinyl gloves. Never wash and re-use them.
- Wash your hands after removing gloves.

Face Masks and Protective Eyewear

Face masks, face shields, and protective eyewear are used to protect the mucous membranes of the eyes, nose and mouth. They should be worn whenever there is a chance that blood or other materials will splash, spatter, or spray.

Face masks cover the nose and mouth. They are disposable and should be discarded after use with each patient. Also, replace them if they become wet during a procedure.

Face shields cover the entire face and extend below the chin.

Protective eyewear covers the eyes and the entire area surrounding the eyes. Regular eyeglasses are not an effective barrier because they do not protect the eyes from the side.

To remove a face mask and eyewear:

- Wash your hands first.
- Handle the face mask by the ties or strings and discard it in the appropriate container.
- Handle the eyewear by the arms and decontaminate it before using it again. Wear gloves while decontaminating.
- Wash your hands.

Protective Clothing

Protective clothing is used to prevent blood or other infectious materials from passing through to your uniform or other clothing. Disposable gowns must be worn when splashes or spills of infectious material are likely to happen.

To remove a soiled disposable gown:

- Do not touch the outside of the gown.
- Keep it away from your body and roll the gown into a ball so that the contaminated side is in the center.
- Dispose of the gown after removing your gloves.
- Wash your hands.

WORK PRACTICE CONTROLS

In addition to the appropriate use of personal protective equipment, there are other work practice controls that must be observed. Handling sharps, working with lab materials, decontaminating work areas, instruments and equipment, and disposing of regulated waste must be performed according to safety regulations. It is also attentive to your personal hygiene and health.

Handling Sharps

Contaminated needles and other sharps must be handled carefully to avoid puncture wounds. To prevent injury and transmission of infection:

- Immediately discard used disposable needles in containers that are clearly marked, closeable, puncture resistant, and leakproof on the sides and bottom.
- Have sharp containers readily available and replace them before they become overfilled.
- Do not recap needles unless it is absolutely necessary. If recapping is unavoidable, use the one-handed scoop method or recapping device.

Handling Lab Materials

Precautions must be taken when handling lab materials. For transport of blood, body fluids, or other specimens, place them in containers that prevent leakage and are marked with the biohazard label. To protect others who may handle the container, make sure the outside is not contaminated.

Warning labels must also be applied to containers used to store blood or infectious materials, such as refrigerators, freezers, and cabinets. Do not store food and drink items in locations where lab materials and potentially infectious materials are present.

Decontamination Procedures

Special precautions and techniques must be used to decontaminate work areas, instruments, and equipment.

Decontaminating Spills

Proper clean up of spills helps protect you and others from exposure.

- Always wear utility gloves.
- Wipe up the spill with a towel, then dispose of the contaminated towel.
- Apply an approved disinfectant according to manufacture's directions.

Decontaminating Patient Care Area

Standard cleaning and decontamination procedures apply to patient care areas.

- Wear utility gloves and use products approved by the Environmental Protection Agency.
- Use hot, soapy water to remove secretions before disinfection. One part household bleach to 10 parts water is adequate for disinfection.
- Protective coverings may be placed on surfaces and objects in the room that may become contaminated while on the job. Discard these coverings and replace with clean coverings after use with each patient. All contaminated equipment and reusable supplies must be decontaminated prior to removal from the patient's home.

Decontaminating Equipment

All contaminated equipment and reusable supplies must be decontaminated before removal from the home. If portions of the equipment cannot be decontaminated, be sure to attach a warning label specifying where contamination may exist.

Handling Laundry

Linens contaminated with blood or other infectious material should be handled as little as possible.

- Wear protective gloves. Roll soiled linens away from your body.
- Clean soiled linens right away. Do not store for later cleaning.
- Remove bulk excrement and gross body fluids from soiled linens with disposable tissues or towels, then flush tissues or towels down the toilet.

Standard laundry and dishwashing cycles are appropriate for linens, dishes, glassware, and eating utensils. Follow the machine and detergent manufactures' instructions.

Disposing of Waste

Disposal of infectious waste is regulated by OSHA and the Environmental Protection Agency. In addition, most states have regulations that require special handling of infectious waste. Regulated waste is liquid or semi-liquid, or other potentially infectious material; contaminated items that would release infectious material if compressed, or would allow dried material to be released during handling. It must be placed in containers that are closeable, prevent leakage, and are color-coded red or clearly labeled "bio-hazard." Laws may require that materials be collected separately from other trash. If an item is grossly soiled, or if the waste container is damaged or the outside of the container is contaminated, carefully place it inside another qualified container to protect others who may handle it. Check with your supervisor to find out where and how to dispose of the waste.

Personal Hygiene and Health

Because it is possible for a pregnant woman to become infected and to transmit bloodborne infection to the unborn child, pregnant healthcare workers can protect themselves and their unborn children by adhering to precautions.

If you have an oozing wound or sore, or if medications have weakened your immune system, consult your physician or employer. Special precautions may be necessary.

POST-EXPOSURE RESPONSE

If you become exposed to blood or potentially infectious material, you must take action immediately.

- Immediately wash any body parts that have been exposed to blood or other potentially infectious materials. Scrub the exposed area vigorously with soap, preferably a disinfectant skin cleaner, and water.
- If the exposure involves mucous membranes, flush the area immediately with water or saline for 3 minutes.
- Notify your supervisor and file an exposure incident report. A post-exposure confidential medical evaluation will be provided.

The medical evaluation will include: an assessment of your exposure risk, information about bloodborne pathogens, an explanation or recommended testing, advice on future evaluations, precautions you should take, and a copy of the healthcare professional's written opinion. If state law allows, the source individual should be evaluated for bloodborne infection and the results made known to you.

OSHA also recommends a blood test immediately after exposure to be used as a baseline. Follow-up testing will determine if transmission has occurred.

- HIV - recommended testing includes HIV testing as soon as possible after the exposure and again at 6 weeks, 12 weeks, and 6 months. If medically indicated, treatment with AZT or other drugs may be considered.
- HBV - if you have never been vaccinated for hepatitis B, testing for hepatitis antigen and antibody should be performed and injections of hyperimmune globulin should be given, preferably within 24 hours of exposure. The series of hepatitis B vaccine injections should also begin at this time. If you have been vaccinated, your level of immunity may need to be assessed by an antibody test.
- HCV – testing may be necessary.

The information in your medical record will be kept confidential.

TUBERCULOSIS: PREVENTION AND PRACTICES FOR THE HEALTHCARE WORKER

Tuberculosis was the scourge of American cities in the late 19th century. Medical advances and improvements in social conditions had reduced the number of cases to the point that by the end of the 1970's tuberculosis was becoming a thing of the past. Healthcare providers expected the disease to be eliminated in the U.S. by the year 2010.

But in the mid-1980's, the downward trend started to reverse as more and more cases began to be reported. By the 1990's, there had been a significant increase in the number of active tuberculosis cases and tuberculosis is once again a disease of great concern. Studies show that more than 26,000 Americans were diagnosed with tuberculosis in 1993. It is estimated that 10 to 15 million people are infected with tuberculosis in the United States.

There are several high risk groups known to have a high rate of tuberculosis infection. They include:

- Homeless person.
- Elderly.
- Residents of long-term facilities, such as prison or nursing homes.
- Alcoholics.
- IV drug users.
- Persons infected with HIV virus.
- Persons having contact with a tuberculosis patient, such as family members and caregivers.

Those co-infected with tuberculosis and HIV have an approximately 8 percent chance per year of developing active tuberculosis. On the other hand, untreated persons infected with tuberculosis but not HIV have a 5 to 10 percent of developing active tuberculosis in their lifetime. There may also be a delay in the diagnosis of tuberculosis in clients with HIV because it is often not typical in its presentation.

There are several racial and ethnic groups that are known to be at a high risk for tuberculosis due to socioeconomic factors. They include:

- Asians
- Pacific Islanders
- Blacks
- Hispanics
- Native Americans

Tuberculosis is also more common among foreignborn persons who have come to the U.S. from regions of the world that have a high rate of tuberculosis, such as Asia, Africa, Caribbean, and Latin America.

Children between the ages of 5 and 14 years have the lowest rate of developing tuberculosis. Infants have the highest rate. Eighty-four percent of the children who do contract the disease are member of, or live with people who are in the high risk groups mentioned above.

TUBERCULOSIS INFECTION VS. DISEASE

Tuberculosis is an infectious disease caused by bacteria known as *Mycobacterium Tuberculosis*, often called tubercle bacilli. It most commonly affects the respiratory system destroying parts of the lung tissue, but other parts of the body can also become infected. The body responds to tubercle bacilli by forming a wall of cells and fibers around the bacilli to confine them. The formation becomes a small, hard lump called a tubercle. In the lungs, the elastic tissue is destroyed and replaced with fibrous connective tissue.

When a person is infected with these bacteria and there are no symptoms, the condition is called tuberculosis infection or latent tuberculosis. It is estimated that 4 to 6 percent of all Americans have tuberculosis infections. Infected persons are not able to spread the infection to others, but, unless treated, the bacteria may become active at anytime. Ninety percent of those infected never develop the disease. Of the remaining ten percent of infected individuals, five percent will develop TB disease within 1-2 years, and five percent will develop the disease later in life.

Tuberculosis infection is treated with the drug isoniazid for 6-12 months, which is 90 percent effective in preventing inactive tuberculosis infection from becoming active tuberculosis. If the infection is untreated, active tuberculosis or tuberculosis disease may develop.

SYMPTOMS OF TUBERCULOSIS DISEASE

The symptoms of tuberculosis disease are often subtle, but may become increasingly severe over time. They include:

- Fatigue
- Loss of appetite

- Fever
- Night sweats

Symptoms of tuberculosis in the lungs may include:

- Chest pain
- Persistent cough
- Sputum containing blood

Extrapulmonary TB is tuberculosis disease found in other parts of the body, such as:

- Larynx
- Brain
- Kidneys
- Bones
- Lymph nodes

Tuberculosis of the spine may cause back pain, and tuberculosis of the kidneys may cause blood in the urine.

Tuberculosis can also affect the gastrointestinal, genitourinary, and central nervous system.

Those at high risk for developing the disease once infected include: persons with HIV or suppressed immune systems, the chronically ill, substance abusers, and individuals recently infected or inadequately treated.

MULTI-DRUG RESISTANT TUBERCULOSIS

Strains of tuberculosis have developed over the years that have become resistant to many of the drugs used for tuberculosis treatment, making successful treatment more difficult. They are known as multi-drug resistant tuberculosis. They are especially hazardous because there is often a delay in recognizing that a patient has multi-drug resistant tuberculosis, during which time they can remain infectious and transmit drug resistant tuberculosis to others.

Multi-drug resistant tuberculosis can develop in anyone being treated for tuberculosis if they take their medications erratically or do not follow the prescribed drug regimen. This situation often arises because of the length of the drug treatment. Patients usually need to take medication for six to nine months, but treatment can be as long as two years for drug resistant tuberculosis. During this time the patient may begin to feel better and may stop taking some of the medications before the treatment is over and the disease is cured. The patient may also stop because of drug side effects, such as nausea. The problem is even more common among patients who cannot afford healthcare or who are transient. Multi-drug resistant tuberculosis can also develop when the patient is prescribed inappropriate drugs or dosages. Multi-drug resistant tuberculosis is increasing. One study in New York City found that a third of the reported cases of tuberculosis were resistant to at least one drug. About 20 percent of the cases studied showed resistance to two of the most effective drugs used to treat tuberculosis, isoniazid and rifampin. Nationwide, nearly 15 percent of reported tuberculosis cases are resistant to at least one drug, and 3.3 percent are resistant to two.

Recently, researchers have identified a gene linked to isoniazid resistance. This discovery should eventually lead to the development of better drugs to treat tuberculosis.

TRANSMISSION OF TUBERCULOSIS

Tuberculosis is spread by airborne transmission. Infectious droplets of fluid called droplet nuclei can be produced whenever a person with tuberculosis disease sneezes, coughs, sings, talks, shouts or breathes. These actions generate droplet nuclei by projecting the tiny droplets into the air where they become suspended. A person can inhale this contaminated air and become infected with the bacteria.

Since tuberculosis is transmitted through the air, healthcare professionals are at special risk for contracting it because they often work in a confined setting. The Centers for Disease Control has published recommendations for preventing the transmission of tuberculosis.

- Screening of patients at high risk of tuberculosis
- Rapid diagnosis
- Appropriate therapy
- Reducing air contamination

- Providing isolation rooms
- Screening healthcare personnel
- Investigating and controlling outbreaks
- Patient screening and treatment

The Mantoux tuberculin skin test is the most common way to screen patients with a suspected tuberculosis infection. In most people, a positive test reaction indicates that person is infected with tuberculosis, even when the disease is not active. A negative test reaction usually indicates non-infection, but some populations, including HIV infected persons, are prone to false negative results.

Certain symptoms, chest X-rays, and sputum smears can lead to the diagnosis of active tuberculosis, but a culture is necessary to confirm the diagnosis. Rapid diagnosis of tuberculosis is critical because people with active tuberculosis can spread the infection to other people during the time it takes to diagnose their disease.

Making a rapid diagnosis may be difficult in people with suppressed immune systems, such as people co-infected with HIV and tuberculosis. In HIV infected patients, the disease may not develop in the typical manner, and symptoms are sometimes masked by other problems, such as pneumonia. Because an abnormal chest X-ray is not unusual in an HIV infected patient, the physician may not suspect TB. Also, the HIV infected person has a suppressed immune system which can produce a false negative TB skin test. Whenever an HIV infected patient shows possible signs for tuberculosis, such as persistent cough, weight loss, and fever, tuberculosis should always be considered and investigated as a cause of illness.

Once diagnosed, the appropriate therapy must begin immediately. Unless it is a multi-drug resistant strain, the curative therapy will quickly eliminate a large number of bacilli and reduce the cough, and render the patient non-infectious in about three weeks. The therapy is extensive, lasting from 6-24 months, depending on the location of the infection, the strain of TB, and the condition of the patient.

To cure tuberculosis, it is imperative that the appropriate drugs in the correct dosages are taken for the prescribed length of time.

Reducing Air Contamination

Transmission of tuberculosis requires inhalation of airborne droplet nuclei that measure only 1 to 5 microns in size – smaller than dust particles. By reducing at the source the amount of droplet nuclei getting into the air, the risk of becoming infected with tuberculosis is reduced.

The easiest way to reduce air contamination is by the patient covering the mouth with tissues when coughing. This is a simple, but effective means of preventing droplet nuclei from entering the air.

Patient isolation is another means of preventing the spread of tuberculosis. By removing the contagious tuberculosis patient from the rest of the household, the amount of droplet nuclei in the home is reduced.

Ventilation using fans and open windows are other ways of reducing air contamination.

Masks and Respirators

Surgical masks are worn by patients to control the source of infection by reducing air contamination. TB patients should wear surgical masks anytime they leave their room or leave home.

A disposable particulate respirator, or PR, containing a High Efficiency Particulate Air (HEPA) filter is required for healthcare workers whenever in close contact with a known or suspected infectious TB patient. The mask is capable of filtering particles as small as tuberculosis droplet nuclei. When fitted properly, the mask makes a complete seal around the face, keeping unfiltered air out. It should always be worn when performing any cough-inducing procedure, such as sputum collection or endotracheal suctioning. It is also recommended when giving aerosolized pentamidine to HIV patients or others with suspected or confirmed diagnosis of tuberculosis. Healthcare workers caring for infectious tuberculosis patients must be fit tested and trained in proper use, care, and fit check procedures for disposable particulate respirators.

Screening Healthcare Personnel and Controlling Outbreaks

Healthcare personnel should be screened for tuberculosis at least once per year in environments where tuberculosis patients are seen or treated. Healthcare workers should be tested every six months in a high-risk setting, such as caring for a TB patient. Check with your supervisor to find out how often you should be tested.

The Mantoux skin test is a simple procedure. A dose of purified protein derivative from tubercle bacilli is injected into the upper layer of skin, usually in the inside of the forearm. Although the tubercle bacilli has been altered to be non-infectious, it is still capable of creating a reaction.

Between 48 to 72 hours later, the test site is examined by trained medical personnel. In most cases, a hardened area of tissue (induration) 10 millimeters or larger, is considered an indication of a tuberculosis infection. But a positive result is not necessarily an indication of having tuberculosis disease. Chest X-rays, and sputum smears and cultures are used to test for active tuberculosis.

If you test positive for tuberculosis infection, notify your supervisor and seek a prompt medical evaluation. The administration should conduct a thorough investigation whenever a healthcare worker or patient becomes infected with tuberculosis. The infected person should consult a physician experienced in the management of TB.

Infectious diseases are on the rise. The methods discussed in this course are essential in preventing and controlling the spread of these diseases. It is important that you learn these procedures and apply them on the job.

LEARNING ACTIVITIES

1. Tasks Requiring Personal Protective Equipment

Directions: Select one of your patients. List the tasks you perform in that patient’s homecare environment. For each task, place a checkmark under each type of personal protective equipment you should wear when you perform the task. *For example*, cleaning the patient care area requires the use of utility gloves. So a checkmark would be placed in the utility glove column.

NAME OF PATIENT: _____

Task	Non-sterile Gloves	Sterile Gloves	Utility Gloves	Face Mask	Face Shield	Eye Protection	Protective Clothing

2. What are the steps that should be followed after an exposure incident? List them below.
